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Intergenerational Transmission of Inflation Preferences and Monetary Institutions: Theory and Evidence

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Intergenerational Transmission of Inflation Preferences and Monetary Institutions: Theory and Evidence*

Etienne Farvaque[†] and Alexander Mihailov[‡]

January 2012

Abstract

We develop an overlapping-generations framework with endogenous heterogeneous inflation preferences that incorporates adaptive learning and imperfect empathy. Preference transmission occurs via a process of socialization, whereby parents and peers affect the adoption of a particular type revealed at adulthood. Agents then optimize the degree of lifetime inflation protection to be enacted as mandate for the monetary authority. Voting equilibria consequently modify the evolving monetary institutions of a society. Empirical tests, employing an inflation aversion measure we construct from survey data and apply to central bank independence, provide cross-sectional evidence in support of our theory.

JEL classification: D72, D83, E31, E58, H41, J10

Key words: intergenerational transmission, endogenous preferences, adaptive learning, evolving institutions, inflation aversion, central bank independence

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1 Introduction

Is low inflation here to stay? Several strands of research provide hints about the likely permanence of the contemporary low-inflation regime. Some insist on the evolution of monetary institutions, more independent and more focused on price stability during the recent period of Great Moderation than in the last episode of Great Inflation (Crowe and Meade, 2007). Others point to globalization as a weight on inflationary pressures (Gamber and Hung, 2001; Rogoff, 2003). Still others add to the above observations that central banks have been learning to control inflation better (Sargent, 1999). More deeply rooted explanations of inflation preferences link them to the inflation experiences people have gone through within their own lifetime (Malmendier and Nagel, 2009) and the 'inflation culture' societies have built through history (Hayo, 1998; Vaubel, 2003).

There is a voluminous literature on the dynamics of higher-frequency inflation – i.e., observed monthly, quarterly or yearly – over shorter-run horizons of a few decades (Rudd and Whelan, 2006, in a closed-economy set-up; Mihailov et al., 2011, in a small open-economy set-up). Not much is known, however, on what drives lower-frequency inflation – i.e., observed within a lifetime – over longer-run spans of time. In such a context, endogenizing individual inflation preferences and modeling their aggregation and transmission across generations is fundamental.

Whereas most of the literature in economics assumes preferences as 'priors' which are endowed to agents and do not change, a more promising route to understand the key determinants and the sustainability of the recent low-inflation regime is to look at preferences as shaped out by evolutionary and cultural forces in society. Dual inheritance theory in anthropology and other social sciences, treated at length in Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (1985), suggests that genes (or 'nature') are not the only factor responsible in influencing traits and practices of individuals. Culture, defined in a general sense as imitative or social learning typical mostly for humans (and often dubbed 'nurture'), is the other crucial factor, whose importance may even be overwhelming. Indeed, based on experimental eliciting of preferences over giving and risk-taking from a subject pool of twins, Cesarini et al. (2009) estimate that only about 20% of individual variation is explained by genetic differences. Moreover, while it takes a large number of generations for genes to mutate, beliefs, values and behavior inherited as culture – and the resulting institutions – can be modified much faster, in a generation or two, as individuals and societies adapt in response to observation and experience.

In particular, when it comes to the intergenerational transmission of socially-relevant attitudes, such as those with regard to inflation, the entire effect on the dynamics of preferences would be rather due to the interactions of transmitted culture with adaptive learning and evolving institutions, as we argue in the present paper. Dessí (2008) relates individual internalization of cultural norms and values to the quality of the existing institutions, while Dohmen et al. (forthcoming) find empirical evidence in favor of the intergenerational transmission within families of the willingness to take risk or trust others.[1] Of course, culture, attitudes and institutions are ultimately moulded by history, as relevant past experience – e.g., hyperinflationary episodes and the abrupt shifts in voting majorities and monetary institutions they cause – is then transferred as social inheritance to the next generations. It would, thus, appear natural that, as Scheve (2004) reports, there is significant cross-country variation in inflation aversion.

In this paper we endogenize inflation preferences as being culturally transmitted from one generation to another. More precisely, we develop an overlapping-generations (OLG) framework with two types of agents distinguished by inflation preferences that arise from an adopted endowment structure available over adulthood. Our framework incorporates adaptive learning and imperfect empathy, and three interdependent channels that drive the socioeconomic dynamics we aim to highlight. Preference transmission operates through the first channel, 'socialization', a process whereby parents and peers affect the adoption of inflation preferences, as they experience the consequences of actual inflation during their lifetime. Then, at the threshold of adulthood, each next generation updates under full information the conditional inflation forecast over the horizon of its own mature life. This is the second, 'learning', channel of socioeconomic dynamics captured by our set-up, whereby generations learn asymptotically the unconditional mean of low-frequency, or generational, inflation. Finally, given heterogeneity in types predetermined by socialization but the same lifetime inflation forecast due to common knowledge, agents optimally choose the degree of lifetime inflation protection they would wish to see enacted as mandate for the monetary authority. Voting equilibria at the beginning of mature life of every generation thus modify the evolving monetary institutions of a society, which is the third channel, 'institutionalization', affecting the degree of monetary control in our theoretical modeling and of central bank independence (CBI) in its empirical translation. Combining the three channels of socioeconomic dynamics we highlight, learning, socialization and institutionalization, allows us to investigate the longer-run evolution of inflation preferences and monetary institutions.

In implementing this approach, we follow Bisin and Verdier (2000, 2001) who build on the literature within economics on endogenous preferences[2] to develop and analyze formal set-ups where preferences evolve across generations. We extend their work in three ways. First, we replace the 'cultural substitution' assumption – that causes convergence to an interior steady state with both types coexisting over time in their purely deterministic framework – with adaptive learning in a dynamic-stochastic environment.[3] Our approach generalizes their result to switching majorities and irregular cycles of higher and lower degree of inflation aversion in the population fluctuating around interior equilibria lasting

[1] However, Black et al. (2005) find limited within-family intergenerational spillover of human capital in their sample studying educational reforms in Norway in the 1960s. This points to the role played by variations in socialization efforts as well as outside-family influences we highlight later on.

[2] Going back to Becker (1976), Hirshleifer (1977) and Rubin and Paul (1979); Becker (1996) is a widely cited book.

[3] For an early analysis of social learning and personality development in cognitive psychology, see, e.g., Bandura and Walters (1963); for a compact survey of learning models in economics, see, e.g., Sobel (2000).

for shorter or longer, or forever (depending on initial conditions and the properties of the assumed shock processes). Second, we apply the model to study endogenously arising inflation preferences and the resulting evolving monetary institutions, in a theoretical context as well as through simulations. Third, we take the theory to an appropriate data set to verify its principal empirical implications, making use of a novel measure of a nation's inflation aversion we construct from survey data. We report robust cross-section evidence that a country's demographic structure, in particular the variation in the share of retirees (our proxy for the more inflation-averse type, as our model and data suggested) or of their ratio to the share of workers (our proxy for the less inflation-averse type), is a key driver of social preferences with regard to inflation. The presented regressions also confirm the importance of two other major long-run determinants of inflation aversion consistent with our model, namely, experience with past high inflation and the degree of CBI embodied in monetary institutions. Our econometric findings, thus, broadly support our analytical framework and simulation results.

It may seem surprising that very few papers have examined the long-run stability of inflation aversion. In addition to the assumption of fixed preferences in theoretical models, this outcome probably also reflects a simple empirical trend: economists now generally admit that CBI – enshrined in laws and regulations in many countries over the last two decades – reveals a society's inflation aversion. From such a perspective, then, everything appears as if the world has evolved towards higher inflation aversion, evidenced by the rising number of central banks made independent or, for the ones which were already, by the increase in their degree of independence (Crowe and Meade, 2007; Arnone et al., 2009). Yet, though the trend has been towards more independence, we do not know whether a reversal would not occur in the future. Such a scenario is not unlikely, for several reasons captured in our model: the underlying low-frequency inflation process may be subject to shifts or switches, monetary policy control over inflation may weaken or strengthen, objectives and constraints of monetary authorities may evolve accordingly, and political economy considerations will not cease to matter, e.g., legal attempts to restrict CBI can be rewarding for short-sighted politicians (Waller, 1991). Hence, this paper delves deeper by exploring the long-run drivers of inflation preferences and monetary institutions.

The paper is further organized as follows. In the next section, we present our OLG model in a baseline and an extended version and derive our main theoretical results. Section 3 illustrates the dynamics of our model, first analytically for a deterministic benchmark and then in simulations under alternative parametrizations for the stochastic version implied by our theory. In section 4, we test empirically the key predictions derived from the model. Section 5 provides a concluding summary.

2 Theoretical Framework

We here build on the OLG set-up of Bisin and Verdier (2000, 2001), to extend and apply it to adaptive learning and the long-run evolution of endogenous inflation preferences and monetary institutions.

2.1 Preference Types

A generation consists of a continuum of individuals, each living for two periods (childhood and adulthood) and having one child. The population is thus constant, and the size of the mature generation in any period t is normalized to 1. We consider two types of preferences in the population, $i \in \{a, b\}$, defined on a private good c and a public good G, as is customary in the public economics literature.

We assume that preference types are complete, or revealed, at the beginning of adulthood (in any period t), which coincides with the end of a socialization process during childhood (in the preceding period $t-1$) described further below. To simplify, we assume throughout that types remain unchanged during adulthood.[4] A type can then be interpreted, in a broad sense, as reflecting a particular endowment of nominal and real assets and human capital ('wealth') available over adulthood, or the adoption of a particular mature-lifetime 'portfolio ideology' or 'inflation-risk behavior'. Along such lines, we model our preference types as arising from differences in the structure of an otherwise equal initial nominal endowment, ϖ. In the beginning of their mature life spanning over a given period t, individuals of a generation that we denote also by t receive this identical time-invariant lifetime endowment ϖ which is, however, differentiated – or, rather, predetermined – by type. If an individual is socialized as (i.e., revealed to be of) type i, she 'is assigned' an initial-period lifetime endowment of which a fraction, $0 < \varphi^i < 1$, is protected (indexed or otherwise privately diversified) against inflation.[5] The real value of her private final-period endowment is therefore

$$\varpi_t^i \equiv \varphi^i \varpi + \frac{\left(1 - \varphi^i\right) \varpi}{1 + \pi_t} - G_t^*. \tag{1}$$

π_t denotes the (net) rate of low-frequency inflation (say, in % per annum, as an average) over a mature-generation life span t. Type b differs in that her initial endowment is indexed (or diversified) against inflation to a *higher* extent, $\varphi^b > \varphi^a = 0$. We further assume that the low-frequency, or generational, inflation dynamics at the centre of our interest would depend – among other things – in part on its own past, and in part on the contemporaneous institutionalized degree of imperfect control a monetary authority exerts over inflation (applicable as from the beginning of each period), as well as on some disturbance process, ε_t, i.e., $\pi_t = \pi(\pi_{t-1}, \pi_{t-2}, ...; G_t^*; \varepsilon_t; \cdot)$. $G_t^* \equiv \chi^i \widehat{\mu}_{\pi,t-1}$ is the cost of

[4] As in Acemoglu and Jackson (2011), this can be rationalized by some prohibitively high cost to change one's type and, hence, behavior, later in mature life. Moreover, Huggett et al. (2011) find that, as of age 23, differences in initial conditions account for more of the variation in lifetime earnings, lifetime wealth and lifetime utility than do differences in shocks received over the working lifetime.

[5] Taking a formal and abstract approach here, we do not go into modeling any specific variety of such inflation-indexed financial instruments or inflation-protecting diversification portfolio strategies. To mention just some widely used real-world examples, one may think of the Treasury Inflation-Protected Securities (TIPS) issued in the US by the federal government since 1997 as well as of their private-sector analogue known as Corporate Inflation-Protected Securities (CIPS): see, e.g., Barney and Harvey (2009).

public protection against inflation everybody has to pay, with $0 \leq \chi^i \leq 1$ and $\widehat{\mu}_{\pi,t-1}$ denoting the conditional mean of inflation observed through generation $t-1$, as will be made more precise further down.

2.2 Learning from History

To keep the set-up as simple and general as possible, we specify the actual law of motion (ALM) of low-frequency inflation as a first-order autoregressive (AR(1)) stochastic process with a time-varying 'institutional-control' drift,

$$\pi_t = -G_t^* + \rho\pi_{t-1} + \varepsilon_t, \tag{2}$$

where $0 \leq \rho \leq 1$ is the persistence parameter of low-frequency inflation and ε_t is a normal i.i.d. inflation-shock process, $\varepsilon_t \rightsquigarrow \mathcal{N}iid\left(\mu_\varepsilon, \sigma_\varepsilon^2\right)$. Both types are assumed boundedly rational in the sense of learning adaptively as history unfolds. Under perfect information and with such a minor deviation from full rationality, agents correctly guess the linear form of this stochastic ALM and the properties of the exogenous shock and the drift term, but do not know the true values of ρ, μ_ε and σ_ε^2. However, at the end of every period t they observe π_t and update its conditional mean $\widehat{\mu}_{\pi,t}$. Generations will, therefore, be converging to the true mean of the inflation process in (2) asymptotically, $\widehat{\mu}_{\pi,t\to\infty} \to \mu_\pi$. Of course, this will be so as long as ε_t and π_t do not change (frequently) their respective laws of motion.

Yet, in our very general set-up agents will not be able to apply recursively ordinary least squares (OLS) under $\mu_\varepsilon \neq 0$ and $G_t^* \neq G = const$ as in (2) and to separate apart estimates of $\widehat{\rho}_t$ and $\widehat{\mu}_\varepsilon$ each period. In that our approach differs from the literature on least-squares learning (as expounded in Evans and Honkapohja, 2001), which relates to a more restrictive scenario assuming a (known) zero-mean $\mathcal{N}iid$ shock process, $\varepsilon_t \rightsquigarrow \mathcal{N}iid\left(0, \sigma_\varepsilon^2\right)$, and a constant intercept, G. In the latter simpler case and under a decreasing-gain learning algorithm,[6] the perceived law of motion (PLM) all agents use to forecast inflation over their lifetime, conditional on the complete (relevant) history, Ω_t, would be

$$\pi_t = -\widehat{G}_t + \widehat{\rho}_t\pi_{t-1} + \varepsilon_t. \tag{3}$$

From the PLM, (3), agents then would update recursively by OLS, generation after generation, their estimate for G (replacing, in the OLS learning context here, our $-G_t^*$) and ρ in (2), $\widehat{G}_t$ and $\widehat{\rho}_t$ in (3).[7]

In the general case of $\mu_\varepsilon \neq 0$ and $G_t^* \neq G = const$ we study in this paper, agents will have to predict inflation over their mature lifetime t from its sample mean observed up

[6] That guarantees convergence to the implied rational expectations equilibrium (REE) – see Evans and Honkapohja (2001), p. 48.

[7] Alternatively, under certain assumptions ρ could be gradually learned through Bayesian maximum likelihood (ML) estimation, as in Buera et al. (2011), among others.

through $t-1$,

$$E[\pi_t \mid \Omega_t] = \pi_t^e = \widehat{\pi}_t = \widehat{\mu}_{\pi,t-1} \equiv t^{-1}\sum_{s=0}^{t-1}\pi_s \quad (4)$$

conditional on the information set $\Omega_t \equiv \{G_s^*, \pi_{s-1}\}_{s=0}^{t}$ that is common knowledge through historical record. It is well-known in the statistical learning literature (see, e.g., Evans and Honkapohja, 2001, p. 62) that the sample mean in (4) corresponds to – that is, can be equivalently written as – a forecast rule according to which agents form expectations adaptively from past data with a *decreasing* gain deterministic sequence, t^{-1}, so that[8]

$$\pi_t^e = \widehat{\pi}_t = \pi_{t-1}^e + t^{-1}\left(\pi_{t-1} - \pi_{t-1}^e\right). \quad (5)$$

Such adaptive learning process implies that all agents share the same forecast rule for (conditionally) expected inflation, $\widehat{\pi}_t$. As in Malmendier and Nagel (2009), agents can therefore forecast inflation recursively.[9] Note that even if in our case agents know the legislated intercept G_t^* of the low-frequency inflation process, they still have no way to obtain separate estimates of ρ and μ_ε from (2). It is on purpose, for realism's sake, that we keep our interest throughout in this very general case.

2.3 Monetary Institutions

To focus on our point, we interpret the degree of control G_t^* in a narrower sense henceforth, namely as a conservative and independent monetary authority along the lines of Rogoff (1985). In effect, we consider G_t^* to be the degree of independence (plus conservatism) of a central bank institution allowing it to control imperfectly generational inflation. Each type i would optimally wish to enshrine its own preferred degree of CBI, G_t^{i*}, through legislation when voting at the beginning of t. This interpretation introduces a second channel in our model that contributes to mitigate the consequences of high inflation, a publicly chosen one. Majority voting in parliament through proportional representation[10] at the beginning of mature life of each generation decides on a unique degree of CBI to be enacted throughout their adulthood, G_t^*. Such a modeling is consistent with the literature that, at least since Strotz (1955), has shown the importance of precommitment technologies in safeguarding the value of money, and boils down to considering CBI as a public good. On the contrary, the role of central banks in hyperinflations (see Fischer et al., 2002) provides a *reductio ad absurdum* argument that, once they deviate from this

[8] Malmendier and Nagel (2009) use the same decreasing-gain forecast rule in a related, but shorter-run set-up.

[9] Differently from Malmendier and Nagel (2009), our focus is on updating life-span or generational forecasts of low-frequency inflation using a historically accumulating sample, while theirs is on differences in forecasting inflation between young and old agents due to own experiencing of not coinciding inflation samples.

[10] Modeling the political system is out of the scope of this article, and we refer the reader to Faust (1996), Bullard and Waller (2004) or Berentsen and Strub (2009).

objective, central banks harm the economy, and become a public 'bad'. Our low-frequency inflation dynamics in (2) thus captures the related evidence mentioned in the Introduction that the degree of CBI (in addition to its conservatism) tends to be negatively correlated with inflation.

If there is a shift in the voting majority by type at the beginning of t, then G_t^* substantially differs from G_{t-1}^*; otherwise, G_t^* is just an 'update' of G_{t-1}^* by the same type one generation ahead. Thus, for the same value of the sample mean, $\widehat{\mu}_{\pi,t-1}$, the inflation forecast $\widehat{\pi}_t$ will be lower or higher depending on the legislated value of G_t^*. Once G_t^* is voted, throughout t both types pay the social cost of the enacted degree of CBI, experience inflation, which redistributes their real endowments according to (1) and (2), socialize their children, consume up their remaining endowments, and die at the end of t. The described sequence of events is illustrated in Figure 1.

[Figure 1 about here]

Following Bisin and Verdier (2000), we assume that each adult chooses the total amount of the public good, G_t, knowing that everyone in the society, irrespective of preference type, will have to contribute an equal share, $g_t = \frac{G_t}{1}$, towards the cost of providing the public good.[11] Note that in our set-up the benefits and costs of inflation or deflation, and hence of the legislated degree of CBI,[12] are explicitly captured by equations (1) and (2), and affect the final (i.e., real) endowment of each type, ϖ_t^i.

The optimization problem each type solves is considered next. An adult agent i's preferences are represented in an additively separable form,

$$u^i(c_t, G_t) = u^i(c_t) + \gamma_t^i v^i(G_t), \quad \text{with} \quad i \in \{a, b\} \text{ and } \gamma_t^i > 0,$$

where $u(c_t)$ and $v(G_t)$ are strictly concave, increasing functions satisfying $u'(0) = v'(0) = \infty$, and γ_t^i measures the relative weight of the utility from the public good.

As mentioned, a particular degree of CBI, G_t, entails at the same time a social cost, i.e., some function $G_t(\cdot)$. In the CBI literature we quoted, this is usually an aggregate cost to society which can come from several sources. One key source of this cost – to which we limit attention here – comes from the redistribution (and, thus, inequality) inflation induces within and across generations.[13] Without loss of generality and following the huge literature on the provision of public goods, the social cost of CBI is expressed further down in terms of the private good c.

[11] The literature on the private provision of public goods allows a less restrictive setting where each agent chooses his contribution, in units of the consumption good, and the resulting amount of the public good equals the sum of all contributions. We leave this avenue for future research.

[12] Many studies have strongly emphasized such benefits (Berger et al., 2001; Crowe and Meade, 2007), so we avoid their discussion here, to focus on our point.

[13] Another source – which we do not model – could be related to a distortion of the Phillips curve trade-off that causes the sacrifice ratio to increase at low levels of inflation (Akerlof et al., 1996; Benigno and Ricci, 2010).

2.3.1 Inflation-Deflation Symmetry

We first analyze the simplest, baseline version of our model, where inflation and deflation are symmetrically treated in terms of their probability of occurring. This is the case when the unconditional mean of the inflation-shock process is zero, $\mu_\varepsilon = 0$,[14] although agents do not know that. Hence, they would be learning the unconditional mean of inflation by observing the available historical record, generation after generation, as we discussed. Our baseline version, in effect, rationalizes why partial private protection against inflation may not necessarily be beneficial, yet again agents cannot be sure about it; thus, one of the types may not be (willingly) 'passing on' or 'adopting' any degree of partial private protection against inflation via the endowment structure: this is implied by assuming, in our baseline version here, that $\varphi^a = 0$ and $\varphi^b = \varphi > 0$.

If the fraction q_t^i, with $0 \leq q_t^i \leq 1$, of type $i \in \{a, b\}$ individuals at time t is more than a half, then $q_t^i > q_t^j$, and the voting equilibrium degree of CBI solves the maximization program of the type i (identical) agents,[15]

$$\max_{G_t^i} \quad u^i\left(c_t^i, G_t^i\right) \quad \text{s.t. } c_t^i + \frac{G_t^i}{1} \leq \varpi_t^i,$$

so that the corresponding unconstrained optimization problems by type can be written, respectively, as

$$\begin{aligned} \max_{G_t^a} \quad & u^a\left(\frac{\varpi}{1+\widehat{\pi}_t} - G_t^a\right) + \gamma_t^a \upsilon^a\left(G_t^a\right), \\ \max_{G_t^b} \quad & u^b\left[\varphi\varpi + \frac{(1-\varphi)\,\varpi}{1+\widehat{\pi}_t} - G_t^b\right] + \gamma_t^b \upsilon^b\left(G_t^b\right), \end{aligned}$$

with FONCs:

$$\begin{aligned} u^{a\prime}\left(\frac{\varpi}{1+\widehat{\pi}_t} - G_t^{a*}\right) &= \gamma_t^a \upsilon^{a\prime}\left(G_t^{a*}\right), \\ u^{b\prime}\left[\varphi\varpi + \frac{(1-\varphi)\,\varpi}{1+\widehat{\pi}_t} - G_t^{b*}\right] &= \gamma_t^b \upsilon^{b\prime}\left(G_t^{b*}\right). \end{aligned} \tag{6}$$

Equations (6) implicitly define the respective *optimal* social cost, $G_t^{a*}\left(\frac{\varpi}{1+\widehat{\pi}_t}, \gamma_t^a\right)$ and $G_t^{b*}[\varphi\varpi + \frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}, \gamma_t^b]$, which corresponds to the *preferred* degree of CBI by type i agents in any period t. It is a function of the common inflation forecast $\widehat{\pi}_t$ and the type-specific in-built protection against inflation φ^i and public-good weight γ_t^i. Plugging that optimal degree of CBI back into the utility yields the value function. For type a agents, it is:

[14] Starting from initial inflation and CBI degree of zero, $\pi_{-1} = 0$ and $G_0^* = 0$: check the ALM (2).

[15] Note that the budget constraint that follows explicitly states a trade-off, usual in this literature, according to which providing G means foregoing c, for each type i.

$$V^a\left(\frac{\varpi}{1+\widehat{\pi}_t}-G_t^{a*}\right)\equiv \arg\max_{G_t^a}\quad u^a\left(\frac{\varpi}{1+\widehat{\pi}_t}-G_t^a\right)+\gamma_t^a\upsilon^a\left(G_t^a\right)$$
$$=u^a\left[\frac{\varpi}{1+\widehat{\pi}_t}-G_t^{a*}\left(\frac{\varpi}{1+\widehat{\pi}_t},\gamma_t^a\right)\right]+\gamma_t^a\upsilon^a\left[G_t^{a*}\left(\frac{\varpi}{1+\widehat{\pi}_t},\gamma_t^a\right)\right].$$

Because of the optimality of $G_t^{a*}(\cdot)$ and the positivity of $\gamma_t^a > 0$, as well as the uncertainty about positive actual inflation, $\widehat{\pi}_t \neq \pi_t > 0$,

$$V^a\left(\frac{\varpi}{1+\widehat{\pi}_t}-G_t^{a*}\right) > u^a\left(\frac{\varpi}{1+\widehat{\pi}_t}\right),$$

so that it is always in the interest of a type a mature agent to enjoy the public good, here her particular, preferred degree of CBI, $G_t^{a*}(\cdot)$.

Analogously, the value function of type b agents becomes:

$$\begin{aligned}V^b\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}-G_t^{b*}\right] &\equiv \arg\max_{G_t^b}\quad u^b\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}-G_t^b\right]+\gamma_t^b\upsilon^b\left(G_t^b\right)\\ &= u^b\left\{\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}-G_t^{b*}\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t},\gamma_t^b\right]\right\}\\ &\quad +\gamma_t^b\upsilon^b\left\{G_t^{b*}\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t},\gamma_t^b\right]\right\}.\end{aligned}$$

Again, because of the optimality of $G_t^{b*}(\cdot)$ and the positivity of $\gamma_t^b > 0$, as well as the uncertainty about high actual inflation, $\widehat{\pi}_t \neq \pi_t > 0$,

$$V^b\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}-G_t^{b*}\right] > u^b\left[\varphi\varpi+\frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t}\right],$$

so that it is always in the interest of a type b mature agent as well to enjoy the public good, here her particular, preferred degree of CBI, $G_t^{b*}(\cdot)$.

However, the *legislated* degree of CBI each period is unique, as it is determined by the dominant type of agents' preferences via representation in parliament.

Proposition 1 ***(Endogenous Inflation Preferences with Costless Differential Private Inflation Protection and Symmetry of Inflation and Deflation)*** *In our baseline model with costlessly adopted $\varphi^b = \varphi > \varphi^a = 0$ and symmetry of inflation and deflation (since $\mu_\varepsilon = 0$), a-types arise endogenously as* more inflation-averse *than b-types in the sense of optimally supporting a higher degree of public inflation protection through a higher degree of monetary control (proxied by CBI); equivalently, a-types arise endogenously as* less deflation-averse *than b-types. Stated reversely: b-types arise endogenously as* more deflation-averse *than a-types in the sense of optimally supporting a higher degree of public deflation protection through a higher degree of monetary control (proxied by CBI); equivalently, b-types arise endogenously as* less inflation-averse *than b-types.*

Proof. We proceed in three steps, each considering conditional inflation forecasts for some particular period t given legislated G_t^* that are, respectively, (i) positive, $\widehat{\pi}_t > 0$, (ii) negative, $\widehat{\pi}_t < 0$, or (iii) zero, $\widehat{\pi}_t = 0$.

(i) Under $\widehat{\pi}_t > 0$ (i.e., if inflation in the past has prevailed over deflation) we can write the inequality

$$\text{for } \widehat{\pi}_t > 0 : \frac{\varpi}{1+\widehat{\pi}_t} - G_t^* < \varphi\varpi + \frac{(1-\varphi)\,\varpi}{1+\widehat{\pi}_t} - G_t^*$$

and, therefore,

$$G_t^{a*} > G_t^{b*}.$$

Then, both inequalities taken together and related to the FONCs (6) imply

$$u^{a\prime}\left(\frac{\varpi}{1+\widehat{\pi}_t} - G_t^{a*}\right) > u^{b\prime}\left[\varphi\varpi + \frac{(1-\varphi)\,\varpi}{1+\widehat{\pi}_t} - G_t^{b*}\right],$$

and

$$v^{a\prime}\left(G_t^{a*}\right) < v^{b\prime}\left(G_t^{b*}\right),$$

so that, from (6), we have:

$$\text{for } \widehat{\pi}_t > 0 : \gamma_t^a = \frac{u^{a\prime}\left(\frac{\varpi}{1+\widehat{\pi}_t} - G_t^{a*}\right)}{v^{a\prime}\left(G_t^{a*}\right)} > \frac{u^{b\prime}\left[\varphi\varpi + \frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t} - G_t^{b*}\right]}{v^{b\prime}\left(G_t^{b*}\right)} = \gamma_t^b > 0. \qquad (7)$$

That is, for $\widehat{\pi}_t > 0$, (7) derives that a-types are endogenously *more inflation-averse* than b-types, or equivalently, that b-types are endogenously *less inflation-averse* than a-types: $G_t^{a*} > G_t^{b*}$ and $\gamma_t^a > \gamma_t^b$.

(ii) Now under $\widehat{\pi}_t < 0$ (i.e., if deflation in the past has prevailed over inflation), the above logic applies with reversed inequality signs everywhere, to lead to:

$$\text{for } \widehat{\pi}_t < 0 : 0 < \gamma_t^a = \frac{u^{a\prime}\left(\frac{\varpi}{1+\widehat{\pi}_t} - G_t^{a*}\right)}{v^{a\prime}\left(G_t^{a*}\right)} < \frac{u^{b\prime}\left[\varphi\varpi + \frac{(1-\varphi)\varpi}{1+\widehat{\pi}_t} - G_t^{b*}\right]}{v^{b\prime}\left(G_t^{b*}\right)} = \gamma_t^b. \qquad (8)$$

That is, for $\widehat{\pi}_t < 0$, (8) derives that b-types are endogenously *more deflation-averse* than a-types, or equivalently, that a-types are endogenously *less deflation-averse* than b-types: $G_t^{a*} < G_t^{b*}$ and $\gamma_t^a < \gamma_t^b$.

(iii) Finally, under $\widehat{\pi}_t = 0$, the two types of inflation preferences, a and b, will *not* endogenously arise (and will thus be *indistinguishable* from each other): $G_t^{a*} = G_t^{b*}$ and $\gamma_t^a = \gamma_t^b$. ■

Proposition 1 can be interpreted in a straightforward way. The optimal degree of publicly legislated monetary control over inflation/deflation (proxied by CBI plus conservatism) for each type that arises endogenously is shaped by the agent's expected real endowment over mature lifetime, which is in turn affected by the conditionally expected inflation or deflation and the degrees of private and public protection against inflation or deflation. If agents forecast inflation/deflation unanimously and optimally, as in our set-up, given $\widehat{\pi}_t > 0$ ($\widehat{\pi}_t < 0$) a-types (b-types) will have a stronger preference for public protection against inflation (deflation) by a monetary authority that enjoys a higher degree of control in order to lower inflation (deflation) through its legislated mandate. Analytically, the marginal rates of substitution (MRS) of private good consumption for public good consumption across types implied by (7) and (8) differ. Under (7), type a's MRS is higher, which is consistent with the higher degree of inflation aversion of this type, than type b's MRS for any t. Under (8), type a's MRS is lower, which is again consistent with the higher degree of inflation aversion of this type, than type b's MRS for any t.

Corollary 1 ***(Unique Socially-Optimal Zero Inflation with Symmetry of Inflation and Deflation)*** *In our baseline model, the unique socially-optimal (actual) inflation/deflation rate, in the sense that it will not redistribute in terms of (final) real endowments (or wealth, more generally) across types, is zero: $\pi_t^* = 0$, $\forall t$.*

Proof. Follows directly from the proof of Proposition 1, replacing everywhere $\widehat{\pi}_t$ by $\pi_t^* = 0$. ■

Note from (7), replacing everywhere $\widehat{\pi}_t$ by π_t, that any positive rate of inflation, $\pi_t > 0$, *harms* both agent types, but a-types *more* relative to b-types. Inversely, from (8), any negative rate of inflation, i.e., deflation, $\pi_t < 0$, *benefits* again both agent types, and again a-types *more* relative to b-types. Both agent types will be better-off under any deflation rate relative to any inflation rate, reminiscent of the Friedman (1969) rule. Yet only $\pi_t^* = 0$ makes the real endowments of both types equal (also equal to their identical nominal endowments in any t), and thus eliminates the cause for the types being distinct.[16]

To anticipate on the empirical application provided further down, one can think of the retirees in a nation as types a who would seek protection of their pensions and (mostly fixed-income) savings from inflation (Gertler, 1999; Doepke and Schneider, 2006; Fujiwara and Teranishi, 2008) and thus support a higher degree of CBI (plus conservatism) than the active working-age population, to be our proxy for types b. Following minor adaptations, not pursued here, our model could accommodate alternative interpretations of types a versus b as lenders versus borrowers or effective opposition to inflation by the financial sector versus other interest groups (Posen, 1995). Observe as well that, ignoring the inequality effects of redistribution by a non-zero price level change, the Friedman (1969) rule of optimal (mild) deflation is generated by the baseline version of our model: as we stated, (mild) deflation makes better-off both types in terms of real endowments (wealth, more generally), but with a (minimal) redistribution cost in favor of types a. In fact, it is exactly such (potentially high) social redistribution cost that would prevent the Friedman rule here, via socialization and voting as we discuss next, from being systemat-

[16] Of course, such a zero-inflation policy would be implementable only if an egalitarian monetary authority enjoys a complete control over the inflation process and is not influenced by agents who vote on its mandate according to their preference type. We would abstract in this paper from such an unrealistic scenario.

ically violated, in the sense of running away into exploding deflation (or inflation, if the violation is in the opposite direction).

2.3.2 Inflation Aversion with Positive Inflation Expectations

We now consider an extension of the presented baseline set-up where the observed history implies *positive* inflation rates most of the time, as is the empirically relevant case. This rationalizes why partial private protection against inflation, via $\varphi^i > 0$, would characterize *both* types, and would be (willingly) 'inherited' and 'passed on'. Moreover, our extended model also suggests a justification of why agents would accept to pay certain private costs, $\Phi\left(\varphi^b\right) > \Phi\left(\varphi^a\right) > 0$ for $\varphi^b > \varphi^a > 0$, that are assumed predetermined for each type (in the case we consider below) in addition to any (known) social costs $G_t^*(\cdot)$.[17] We introduce such costs here, and analyze next whether and how they modify the conclusions in Proposition 1 and Corollary 1. To save on notation, we henceforth will mostly write $\Phi\left(\varphi^i\right)$ as Φ^i.

Our extended model highlights the following modifications relative to the baseline set-up. In the beginning of their mature life, having received the identical nominal endowment ϖ, agents first make a (realistically, constrained) choice of how much to protect it against expected inflation over their mature lifetime. However, this 'investment' (or 'indexation' or 'diversification') decision regarding the 'restructuring' of their nominal portfolio is still predetermined by their type.[18] Since the particular type is again revealed at the end of the socialization process operating during $t-1$, the two types are still distinct and opt for differential private diversification degrees and, hence, costs, over their mature lifetime in t. To keep the analysis simple, we here model a binary (i.e., type-predetermined) choice of fixed-cost private inflation protection. If an individual is socialized as (i.e., revealed to be of) type i, she chooses to pay a *private* fixed cost $\Phi^i > 0$ to get a (constant) fraction, $0 < \varphi^i < 1$, of her nominal (initial-period) endowment indexed (or otherwise *privately* diversified) against inflation. Her real (final-period and '*privately* selected') endowment is then

$$\varpi_t^{i\Phi} \equiv \varphi^i \varpi + \frac{\left(1-\varphi^i\right)\varpi}{1+\pi_t} - \Phi^i - G_t^*. \tag{9}$$

Type b differs in that she 'chooses' to pay a *higher private* cost $\Phi^b > \Phi^a$ to get her endowment indexed (or diversified) against inflation to a *higher* extent, $\varphi^b > \varphi^a$. In effect, all agents will turn out to value publicly legislated control over inflation by the monetary authority, proxied by CBI, but each type will prefer a different degree of CBI again, which we show next. Types a thus place most of the task of safeguarding against inflation onto the monetary institution with a clearly defined public mandate (or of CBI,

[17] More generally, $\Phi\left(\varphi^i\right)$ could be a monotonically increasing (but bounded – by wealth) function of the respective degrees of private protection against inflation by type i.

[18] Summarizing human capital, risk aversion, inequality aversion, flexibility of objectives and/or constraints, as we suggested.

in our narrower interpretation), imposing an equal legislated social cost for everybody, G_t^*; while types b rely mostly on their own adopted or selected – but, again, predetermined by socialization – indexation strategy, or lifetime portfolio diversification behavior, in a broader context,[19] implying privately covered costs that differ across types. In the rest of the detail, the extended version remains the same as the presented baseline model.

In particular, our extended model sheds light on the endogenously arising socialization effort by type that drives the model dynamics to be discussed in section 3. To clarify this point, we consider our next results.

Proposition 2 ***(Endogenous Inflation Aversion with Costly Differential Private Inflation Protection and Positive Inflation Expectations)*** *In our extended model with (i) prevailing* positive *inflation expectations, $\widehat{\pi}_t > 0$ for most $t = 0, 1, 2...$ (since $\mu_\varepsilon > 0$), and (ii) fixed costs of differential private inflation protection predetermined by type, implied by $\Phi^b \equiv \Phi\left(\varphi^b\right) > \Phi\left(\varphi^a\right) \equiv \Phi^a > 0$ for $1 > \varphi^b > \varphi^a > 0$ and driven by the outcome of socialization, a-types arise endogenously again as* more high-inflation-averse *than b-types in the sense of optimally supporting a higher degree of public inflation protection through a higher degree of monetary control (proxied by CBI).*

Proof. Again, we proceed in three steps.

(i) Under prevailing *positive* conditional expectations of inflation we can follow the logic of case (i) in the Proof of Proposition 1, adapting the anticipated endowments accordingly to reflect the differential private costs. For the expected real endowments to be equal, a particular inflation forecast $\widehat{\pi}_t^*$ must exist such that:

$$\varphi^a \varpi + \frac{(1-\varphi^a)\,\varpi}{1+\widehat{\pi}_t^*} - \Phi^a - G_t^* = \varphi^b \varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t^*} - \Phi^b - G_t^*.$$

Solving for it,

$$\widehat{\pi}_t^* = \widehat{\pi}^* = \frac{\Phi^b - \Phi^a}{\left(\varphi^a - \varphi^b\right)\varpi + \left(\Phi^b - \Phi^a\right)} = const > 0.$$

Now, if $\widehat{\pi}_t \equiv \widehat{\pi}_{t,H} > \widehat{\pi}_t^*$, we are in a case analogous to (i) in Proposition 1 and, therefore,

$$\varphi^a \varpi + \frac{(1-\varphi^a)\,\varpi}{1+\widehat{\pi}_t} - \Phi^a - G_t^* < \varphi^b \varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t} - \Phi^b - G_t^*,$$

so that

$$G_t^{a*} > G_t^{b*}.$$

Then, both inequalities taken together imply

$$u^{a\prime}\left(\varphi^a \varpi + \frac{(1-\varphi^a)\,\varpi}{1+\widehat{\pi}_t} - \Phi^a - G_t^{a*}\right) < u^{b\prime}\left[\varphi^b \varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t} - \Phi^b - G_t^{b*}\right],$$

[19] Given, of course, a particular depth and degree of financial market development we do not model.

and

$$\upsilon^{a\prime}\left(G_t^{a*}\right) > \upsilon^{b\prime}\left(G_t^{b*}\right),$$

so that from (6), we have:

$$\text{for } \widehat{\pi}_t \equiv \widehat{\pi}_{t,H} > \widehat{\pi}_t^* :$$

$$\gamma_t^a = \frac{u^{a\prime}\left(\varphi^a\varpi + \frac{(1-\varphi^a)\varpi}{1+\widehat{\pi}_t} - \Phi^a - G_t^{a*}\right)}{\upsilon^{a\prime}\left(G_t^{a*}\right)} > \frac{u^{b\prime}\left[\varphi^b\varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t} - \Phi^b - G_t^{b*}\right]}{\upsilon^{b\prime}\left(G_t^{b*}\right)} = \gamma_t^b > 0.$$

That is, for $\widehat{\pi}_t \equiv \widehat{\pi}_{t,H} > \widehat{\pi}_t^*$, a-types are endogenously *more high-inflation-averse* than b-types.

(ii) If conversely $\widehat{\pi}_t \equiv \widehat{\pi}_{t,L} < \widehat{\pi}_t^*$, we are in a case analogous to (ii) in Proposition 1 and, therefore,

$$\varphi^a\varpi + \frac{(1-\varphi^a)\varpi}{1+\widehat{\pi}_t} - \Phi^a - G_t^* > \varphi^b\varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t} - \Phi^b - G_t^*,$$

so that the above logic applies with reversed inequality signs everywhere, to lead to:

$$\text{for } \widehat{\pi}_t \equiv \widehat{\pi}_{t,L} < \widehat{\pi}_t^* :$$

$$\gamma_t^a = \frac{u^{a\prime}\left(\varphi^a\varpi + \frac{(1-\varphi^a)\varpi}{1+\widehat{\pi}_t} - \Phi^a - G_t^{a*}\right)}{\upsilon^{a\prime}\left(G_t^{a*}\right)} < \frac{u^{b\prime}\left[\varphi^b\varpi + \frac{\left(1-\varphi^b\right)\varpi}{1+\widehat{\pi}_t} - \Phi^b - G_t^{b*}\right]}{\upsilon^{b\prime}\left(G_t^{b*}\right)} = \gamma_t^b > 0$$

That is, for $\widehat{\pi}_t \equiv \widehat{\pi}_{t,L} < \widehat{\pi}_t^*$, b-types are endogenously *more low-inflation-averse* than a-types: too low inflation makes them worse-off relative to the a-types, due to the higher private costs of inflation protection of b-types over a-types.

(iii) Finally, under $\widehat{\pi}_t \leq 0$, now with private costs of protection the two types of inflation preferences, a and b, still endogenously arise, similarly to (ii) just above: b-types would be losing relative to a-types in such periods and will be more deflation-averse. ■

To sum-up, the result in Proposition 2 concerning our extended model is analogous to the result in Proposition 1 concerning our baseline: a-types are *more* high-inflation-averse than b-types while b-types are *more* low-inflation and deflation-averse than a-types in the extended model. In it, differential fixed private costs of protection against inflation are introduced, but the separation of the agents into paying the higher or the lower of the costs is (still) predetermined by the socialization process that shapes out type adoption.

Another corollary is now in order that justifies a particular positive rate of inflation as socially-optimal in the extended set-up considered here.

Corollary 2 ***(Unique Socially-Optimal Positive Inflation with Positive Inflation Expectations)*** *In our extended model, the unique socially-optimal (actual) inflation rate, in the sense that it will not redistribute in terms of (final) real endowments (or wealth, more generally) across types, is positive:* $\pi_t^* = \frac{\Phi^b - \Phi^a}{\left(\varphi^a - \varphi^b\right)\varpi + \left(\Phi^b - \Phi^a\right)} = const > 0,\ \forall t.$

Proof. Follows directly from the proof of Proposition 2, replacing everywhere $\widehat{\pi}_t$ by $\pi_t^* = \frac{\Phi^b - \Phi^a}{(\varphi^a - \varphi^b)\varpi + (\Phi^b - \Phi^a)}$. ■

2.3.3 Endogenous Socialization Effort

We finally consider a mechanism that generates endogenous socialization effort by type in a generalized version of the set-up we presented thus far that applies to both the baseline and the extended models. Since agents do not know the true mean of the inflation process, in each period t they update their common knowledge of its conditional mean through historical observation. That is, actual inflation each period is $\pi_t = \widehat{\pi}_t + \eta_t$, where η_t is the forecast error and the common inflation forecast across types is $\widehat{\pi}_t \equiv \widehat{\mu}_{\pi,t-1}$. The next period inflation forecast then becomes $\widehat{\pi}_{t+1} \equiv \widehat{\mu}_{\pi,t}$, and so forth.

Conjecture 1 ***(Endogenous Socialization Effort with Reference to Actual Inflation)*** *Given the structure of the endowment of each type (φ^i) and the unanimous conditional inflation forecast in any t ($\widehat{\pi}_t$) in both versions of the model (baseline and extended), $\pi_t = \widehat{\pi}_t + \eta_t$ redistributes in a way that makes the type which* loses more *in relative terms to the other type to socialize the next generation exerting* more effort*, and thus affecting in a stronger way type adoption next period.*

Conjecture 1 follows immediately from the logic of the framework we developed. However, imposing it as a behavioral assumption to endogenize socialization effort would require a very specific calibration of a number of parameters we are not immediately interested in here, such as those determining π_t^* in Corollary 2. While this may be our task in future research, the present paper seeks to provide a more general characterization of endogenous socialization effort in response to relative losses the two types experience while updating the common knowledge of the conditional mean of the generational inflation process. One such convenient and minimally restrictive specification of endogenizing efforts to socialize the next generation as agents learn through history that seems quite appealing in our context, consistent with adaptive learning, is embodied in the second conjecture we make.

Conjecture 2 ***(Endogenous Socialization Effort with Reference to Updating the Conditional Mean of Inflation)*** *Given the structure of the endowment of each type (φ^i) and the unanimous conditional inflation forecast in any t ($\widehat{\pi}_t$) in both versions of the model (baseline and extended), if $\pi_t > \widehat{\pi}_t$ leading to $\widehat{\pi}_{t+1} - \widehat{\pi}_t > 0$, a-types* lose more *from the positive 'surprise generational inflation' and* socialize stronger *relative to b-types; and vice versa, if $\pi_t < \widehat{\pi}_t$ leading to $\widehat{\pi}_{t+1} - \widehat{\pi}_t < 0$, b-types* lose more *from the negative 'surprise generational inflation' and* socialize stronger *relative to a-types.*

The behavioral mechanism we assume in the second conjecture also fits well our theoretical framework. Moreover, its direct purpose is to facilitate the simulation of the model generating its longer-run dynamics we discuss in the next section. In particular, our implementation of the reported simulation results further down is consistent with Conjecture 2.

3 Intergenerational Dynamics of Preferences and Institutions

We continue our analysis focusing next on inflation preference transmission across generations.

3.1 Preference Transmission through Imperfect Empathy

Children are born without well-defined preferences, but acquire them through observation, imitation and adoption of 'cultural models' with which they are matched. This matching, termed 'socialization', naturally comes in two steps and is influenced to some extent by economic choices, but also by parents. Children are first exposed to their parents model (type a or b), and are thus 'matched' with their family, in what is termed 'direct vertical transmission'. If they do not adopt their parent's trait, they are then exposed to the influence of other individuals of the old generation (e.g., teachers, peers, role models) and adopt the preference type of some among these, i.e., 'oblique vertical transmission'.[20] Imperfect empathy, a particular form of myopia we assume throughout the paper, further implies that parents always want to socialize their children to their own preferences and cultural traits.[21]

To examine the mechanism driving the intergenerational transmission of inflation aversion through the socialization channel we assume that a child adopts his parent's preferences with an endogenous probability $\tau^i(\cdot)$, to be made more precise later, with $0 \leq \tau^i(\cdot) \leq 1$, $i \in \{a, b\}$. If not, with probability $1 - \tau^i(\cdot)$, the child is then matched randomly with another individual of the old generation and adopts her preference type.

The transition probabilities at time t, P_t^{ij}, that a parent of type i has a child adopting a preference of type j are then:

$$
\begin{aligned}
P_t^{aa} &= \tau^a(\cdot) + (1 - \tau^a(\cdot))\, q_t^a, \\
P_t^{ab} &= (1 - \tau^a(\cdot))\,(1 - q_t^a), \\
P_t^{bb} &= \tau^b(\cdot) + \left(1 - \tau^b(\cdot)\right) q_t^b = \tau^b(\cdot) + \left(1 - \tau^b(\cdot)\right)(1 - q_t^a), \\
P_t^{ba} &= \left(1 - \tau^b(\cdot)\right)\left(1 - q_t^b\right) = \left(1 - \tau^b(\cdot)\right) q_t^a.
\end{aligned}
$$

[20] This terminology originates in the anthropological and psychological literature and was introduced by Cavalli-Sforza and Feldman (1981). 'Horizontal transmission', which we do not model, occurs within a generation.

[21] Imperfect empathy is a common assumption in the emerging socialization literature within economics. It implies that parents can perceive the welfare of their children only through the filter of their own preferences.

Given these transition probabilities, the fraction q_t^a of adult individuals of type a in period $t+1$ evolves according to:

$$
\begin{aligned}
q_{t+1}^a &= q_t^a P_t^{aa} + q_t^b P_t^{ba} \\
&= q_t^a P_t^{aa} + (1 - q_t^a) P_t^{ba} \\
&= q_t^a + q_t^a (1 - q_t^a) \left(\tau^a(\cdot) - \tau^b(\cdot) \right) \\
&= \left[1 + (1 - q_t^a) \left(\tau^a(\cdot) - \tau^b(\cdot) \right) \right] q_t^a .
\end{aligned}
$$

It is clear that the fraction of type-a agents in the old generation may stay constant across time only if the term in square brackets is equal to 1. This would occur if either (i) $q_t^a = 1$ or (ii) $\tau^a(\cdot) = \tau^b(\cdot)$ or (iii) both. However, case (i) – and, hence, case (iii) – is excluded by assumption for the initial condition ($0 < q_t^a < 1$), as otherwise a stable structure of the mature population preferences emerges, in which the initial type of preferences perpetuates forever. Therefore, only case (ii) remains as a potentially relevant, symmetric option to consider; yet, it defines a steady state for any initial condition, without any evolution of the relative proportions of preferences in the society, and so is uninteresting for economic purposes.

In all other cases, different from (i), (ii) and (iii), the intergenerational dynamics of preferences depends on two factors: first, the proportion of type-a agents inherited from past history, q_t^a, relative to q_t^b; second, the *sign* of the difference of the vertical transmission probabilities, $\tau^a(\cdot) - \tau^b(\cdot)$, which determines the *direction* of preference convergence (toward type a or b). Writing the last-but-one line above as

$$
q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2 \right] \left(\tau^a(\cdot) - \tau^b(\cdot) \right) \tag{10}
$$

delivers a first-order non-linear sequence, which does not admit any general solution even for constant τ^a and τ^b.

3.2 Deterministic Benchmarks

Before proceeding with completing the description of our model and the discussion of the key insights from its simulations, we now summarize the more restrictive and simpler cases the emerging literature on preference transmission has mostly considered.

3.2.1 Exogenous Vertical Preference Transmission

With *exogenous constants* τ^a and τ^b, the law of motion of a-types as a fraction in the total population, (10), becomes

$$
q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2 \right] \left(\tau^a - \tau^b \right) . \tag{11}
$$

Given the standard assumptions with regard to probabilities (as above), namely that τ^a and τ^b are both between 0 and 1, we know that the stability points of this function are 0 and 1.[22] The conditions for convergence then with *exogenously constant* vertical transmission probabilities τ^a and τ^b are obvious:

- If $\tau^a < \tau^b$, then for any initial condition q_0^a, $q_{t\to\infty}^a \to 0$: social preferences will converge towards an economy with only type-b agents, i.e., a lower degree of CBI.
- If $\tau^a > \tau^b$, then for any initial condition q_0^a, $q_{t\to\infty}^a \to 1$: social preferences will converge towards an economy with only type-a agents, i.e., a higher degree of CBI.

Since by the initial condition of preference heterogeneity, $0 < q_0^a < 1$, no case can be ruled out, convergence in this deterministic exogenous preference dynamics equation, (11), will depend on the relative size of τ^a and τ^b. To illustrate this result, we present phase diagrams for the two opposite cases. As can be seen in Figure 2, if the sign of the vertical preference transmission probability differential between types a and b, $\tau^a - \tau^b$, is positive, then the intergenerational dynamics of the fraction of preference type a converges to the steady state S with coordinates $(1,1)$ for any initial condition q_0^a. The process is driven by the *concavity* of the phase diagram curves, drawn for different magnitudes of the mentioned probability differential. This leads to an ultimate adoption of type a agents' preferences – which is the only preference type to survive, while the other type is extinguished. Conversely, Figure 3 shows that if the probability differential $\tau^a - \tau^b$ is negative, then the preferences of society converge to type b at the steady state S' with coordinates $(0,0)$ for any initial condition q_0^a. The *convexity* of the phase diagram curves in this case directs convergence to an ultimate equilibrium where only type b survives.

[Figures 2 and 3 about here]

Interestingly, the *speed* of the preference convergence process depends on (the absolute value of) the *magnitude* of the vertical preference transmission probability differential, itself determining the *curvature* of the path of the fraction of type-a preferences in our two phase diagrams. The larger (the modulus of) this differential (e.g., compare the graphs for 0.9 versus 0.1 in Figure 2 and for -0.9 versus -0.1 in Figure 3), the more curved the path and the quicker the convergence process.

3.2.2 Endogenous Vertical Preference Transmission

Differently from the situations depicted in figures 2 and 3, real-world heterogeneity of beliefs and norms of behavior does not seem to necessarily exhibit such convergence to an ultimate survival of one of the types, with the others extinguished (as in evolutionary

[22] In the case of exogenous constants τ^a and τ^b, our preference transmission model is the logistic map. Let $\tau = \tau^a - \tau^b$; $x_t = \frac{\tau}{1+\tau} q_t^a$ and $r = 1 + \tau$; then equation (11) becomes $x_{t+1} = r x_t (1 - x_t)$. The logistic map is well understood (at least in the range $0 \le r \le 2$, which is implied by $0 \le \tau^i \le 1$): here, the known behavior is equivalent to what we assert about the q_t^i processes.

selection mechanisms). Instead, an equilibrium where different types of preferences coexist would rather be sustained. Certain conditions on the transmission mechanism that induce heterogeneity in the long-run stationary distribution of preferences in the population have been examined by Bisin and Verdier (2001). However, in their set-up this analysis comes at the cost of imposing 'cultural substitution' (as in Sáez-Martí and Sjögren, 2008, too), which may be restrictive. Cultural substitution means that the vertical socialization of children *inside* the family and *outside* the family act as substitutes in the cultural transmission mechanism. Then, there can exist a heterogeneous distribution of preferences in the population which is globally stable. Intuitively, direct transmission acts as a cultural substitute for oblique transmission when parents have less incentives to socialize their children once their own values are widely dominant in the population.

We could have assumed cultural substitution too: the probability of direct vertical socialization to the parent's trait i, τ^i, will be a negative function of the attained level of the fraction in the population with that same trait, q_t^i, at time t; that is, we can write $\tau^i\left(q_t^i\right)$, with $\frac{d}{dq_t^i}\tau^i\left(q_t^i\right) < 0$. Then (10) becomes:

$$q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2\right]\left[\tau^a\left(q_t^a\right) - \tau^b\left(1 - q_t^a\right)\right]. \tag{12}$$

In our context, equation (12) will have the same consequences as in the quoted papers, i.e., converging to an *interior* equilibrium. However, we have argued in section 2 that inflation preferences could more realistically be thought of as a gradual outcome of past- and own-generation experience with inflation, accordingly modulating socialization effort and modifying inherited monetary institutions. This leads us to address next nondeterministic environments where learning from history consistent with our theoretical results in section 2 drives the transmission of preferences and institutional change.

3.3 Stochastic Endogenous Socialization under Learning

Allowing for a richer dynamics requires to endogenize the direct vertical transmission of preferences in a stochastic extension of the standard deterministic socialization set-up just described, also linking it with the low-frequency inflation dynamics equation (2).[23] Combining features we already discussed but keeping the model as straightforward as possible given our objective, we now complete it by incorporating several relevant features.[24]

[23] A detailed description of our simulation results as well as of some further empirical findings is provided in a supplementary appendix. Our codes and data set are also available as a *.zipx archive.

[24] Note that we consider further below immediately the endogenous stochastic dynamics case, where socialization responds to observed inflation given the legislated CBI and the redistributive loss relative to the other type. An exploration of the exogenous stochastic dynamics case would imply to specify stochastic processes for the probabilities of vertical transmission (τ_t^i). Assuming them random variables, e.g., draws from uniform $(0, 1)$ independent distributions each period in the simplest context, would lead one to rewrite (11) as $q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2\right]\left(\tau_t^a - \tau_t^b\right)$. Our simulations of this equation with stochastic τ_t^i's from different q_0^a generate ultimate convergence to either of the types, as in the deterministic exogenous case, within 20 to 100 periods depending on the particularly materialized sequences of $\tau_t^a - \tau_t^b$.

First, and in line with Conjecture 1, we now assume that the probability of vertical socialization to the parent's trait i, τ_t^i, is a positive function of the effort at time t the parent exerts to socialize her child to her own trait, e_t^i: $\tau_t^i\left(e_t^i,\cdot\right)$, with $\frac{\partial}{\partial e_t^i}\tau_t^i\left(e_t^i,\cdot\right)>0$.

Second, in line with Proposition 2 and under its simplification in Conjecture 2, we assume that socialization efforts, e_t^i, are, in turn, a positive function of the change in the conditional mean of inflation $(\widehat{\pi}_t-\widehat{\pi}_{t-1})$ a particular generation t observes over its adulthood, i.e., therefore a function of cumulative historical record up through t. Thus, implementing Conjecture 2, we write: $e_t^i\left(\widehat{\pi}_t-\widehat{\pi}_{t-1},\cdot\right)$, with $\frac{\partial e_t^a(\widehat{\pi}_t-\widehat{\pi}_{t-1},\cdot)}{\partial(\widehat{\pi}_t-\widehat{\pi}_{t-1})}>0$ if $\widehat{\pi}_t-\widehat{\pi}_{t-1}>0$, (as a types are worse-off in such a case than b types, and would require more protection against inflation via a higher legislated degree of CBI next period, $G_{t+1}^*>G_t^*$) while $\frac{\partial e_t^b(\widehat{\pi}_t-\widehat{\pi}_{t-1},\cdot)}{\partial(\widehat{\pi}_t-\widehat{\pi}_{t-1})}>0$ if $\widehat{\pi}_t-\widehat{\pi}_{t-1}<0$ (as b types are worse-off in such a case than a types, and would require less protection against relatively high inflation via a lower degree of CBI, $G_{t+1}^*<G_t^*$). That is, types a react to an observed *rise* in the conditional mean of lifetime inflation by increasing their socialization efforts, while types b react to an observed *fall* in the conditional mean of lifetime inflation by increasing their socialization efforts. Accordingly, we now distinguish a second channel of transmitting inflation preferences by the adult generation to the young which is always operative through socialization during any t, via $e_t^i\left(\widehat{\pi}_t,-\widehat{\pi}_{t-1}\cdot\right)$, in addition to the institutionalization channel which operates through voting in the beginning of each t, via G_t^*, and, therefore, only when majorities shift.

Third, to simplify the simulations, we assume $\chi^a=1$ and $\chi^b=0.5$ so that $G_t^{*a}=\widehat{\pi}_t$ and $G_t^{*b}=0.5\widehat{\pi}_t=0.5G_t^{*a}$ in (2), with the initial condition for inflation being $\pi_0=\mu_\varepsilon$. The latter initialization implies that those of the alternative simulation cases where the mean of the inflation shock is assumed zero, $\mu_\varepsilon=0$, eliminate (by construction in the codes, as above) the drift term in the low-frequency AR(1) stochastic process for inflation and, thus, the feedback from the CBI (or institutional) channel.[25] Our assumption here linking the degree of monetary control G_t^{*a} or G_t^{*b} to the observed conditional mean $\widehat{\pi}_t$ bears some realism and intuitive power, in the sense that each agent type will have some idea of the order of magnitude to which the monetary authority will be able to affect actual inflation π_t over t via the law of motion (2). Moreover, as generations learn (asymptotically) from historical experience the unconditional mean of inflation, the control over actual inflation (asymptotically) increases too.

Using these assumptions, we substitute back into equation (10), to obtain:

$$q_{t+1}^a=q_t^a+\left[q_t^a-\left(q_t^a\right)^2\right]\begin{pmatrix}\tau_t^a\left[e_t^a\left(\widehat{\pi}_t-\widehat{\pi}_{t-1},\cdot\right),\cdot\right]\\-\tau_t^b\left[e_t^b\left(\widehat{\pi}_t-\widehat{\pi}_{t-1},\cdot\right),\cdot\right]\end{pmatrix}. \tag{13}$$

Equations (2) and (13) thus form an interdependent recursive dynamic system in two

[25] Exploring also $\pi_0=\mu_\varepsilon=0$ (and $\sigma_\varepsilon^2=1$) is done on purpose, as it allows direct comparison with the analogous simulation cases that differ only in that $\pi_0=\mu_\varepsilon=2$ (and $\sigma_\varepsilon^2=1$, again). Note that in the former case inflation becomes an AR(1) stochastic process without the institutional drift influence, but not in the latter case.

state variables, π_t and q^a_{t+1}. They also highlight the two channels through which societies transmit values and institutions from a generation to the next, institutionalization and socialization, respectively. Starting from some initial conditions π_0 and q^a_0, implying also a corresponding initial value for G^{i*}_0, the shock realization ε_1 gives π_1 from (2); from (13), then, $\widehat{\pi}_1 - \widehat{\pi}_0$, will first impact the socialization effort across types, next the preference transmission probabilities, and ultimately q^a_1; an so on and so forth in subsequent periods. This chain of effects constitutes the mechanism generating irregular cycles of temporary convergence towards one trait in the population or the other. For example, if in equation (13) past-period inflation (π_{t-1}) has been high (relative to π_{t-2}), socialization ($\tau^a_{t-1}\left[e^a_{t-1}\left(\widehat{\pi}_{t-1} - \widehat{\pi}_{t-2}, \cdot\right), \cdot\right]$) will have taken place in $t-1$, increasing the degree of inflation aversion in the population (q^a_t) and, potentially (i.e., if the majority type has shifted), of CBI too (G^{a*}_t) when voting at the beginning of t. The present-period adult generation in t may thus feel more insulated from the effects of high inflation via the increased CBI, and its effort ($e^a_t\left(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot\right)$) to socialize their own children (to stronger inflation aversion) is more likely to be reduced insofar the higher G^{a*}_t acts to reduce actual inflation for any given realization of the inflation shock in t, via (2). A period of convergence away from the high inflation aversion the preceding generation had built (and potentially transformed in inflation-proof institutions) could then follow. Hence, preference shift cycles can arise and reverse each other, as illustrated next by a summary of our simulations.[26]

To explore further this mechanism, we simulated our dynamic model embodied in the recursive system (2) and (13) over 1000 periods under alternative parameters and shock processes. Our simulations concerning inflation dynamics assumed, alternatively, 3 cases:

1. $\pi_0 = 0\% = \mu_\varepsilon$ and $\sigma^2_\varepsilon = 1$, i.e., a zero-mean inflation regime, or one consistent with zero-inflation steady states in theoretical models;
2. $\pi_0 = 2\% = \mu_\varepsilon$ and $\sigma^2_\varepsilon = 1$, i.e., a low-inflation regime, or one broadly typical for advanced economies over the most recent generation span; and
3. $\pi_0 = 6\% = \mu_\varepsilon$ and $\sigma^2_\varepsilon = 3$ (all these 3 parameters 3 times higher than in case 2), i.e., a high-inflation regime with higher volatility, or one broadly typical for emerging markets over the most recent generation span.

Moreover, all 3 cases were simulated for 3 alternative (constant) values of the parameter measuring low-frequency inflation persistence,[27] $\rho = \{0.1, 0.5, 0.9\}$, and for 3 endogenous vertical probability differentials, $|[\ \tau^a_t e^a_t(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot), \cdot] - \tau^b_t[e^b_t(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot),\ \cdot]| =$

[26]Note that 'nature' also plays a role in the dynamics of the system, by 'drawing' the inflation shock every period. Observe as well that the control society has over nature is necesarily imperfect, operating along both transmission channels only in addition to the draw of nature. While this is certainly a simplification, it captures the main features of endogenous preferences and institutions we highlight here as emerging through learning from history.

[27]Note that in our context persistence of the inflation process at (mature) generation spans (t of the order of 25-30 years) may not necessarily correspond to measured short-run (annual or quarterly t) inflation persistence in the abundant literature. Also, $\rho \to 0$ captures a normal stochastic process for inflation with

$\{0.1, 0.2, 0.5\}$, translating the reaction to observed variation in the conditional mean of generational inflation into corresponding socialization effort and, ultimately, probability differential of passing over the parent's trait to the child across the two types.[28] The magnitude of this differential is thus discretized in the simulations into 3 cases, namely: an absolute value of 0.1 (obtained as in footnote 28) captures the case of a low endogenous vertical probability differential, an absolute value of 0.2 (obtained analogously from probabilities of 0.6 and 0.4) accounts for an intermediate case, and an absolute value of 0.5 (obtained from probabilities of 0.75 and 0.25) features a high vertical probability differential.

To put it briefly, our model simulations point to the following conclusions.[29] First, whenever the resulting vertical transmission probability differential,

$$\left|\tau_t^a\left[e_t^a\left(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot\right), \cdot\right] - \tau_t^b\left[e_t^b\left(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot\right), \cdot\right]\right|,$$

is sufficiently high – of the order of 0.5 or more, convergence occurs to one of the types relatively quickly (sometimes in less than 10 generations). This conclusion remains valid even when starting from an equal initial share in the population, $q_0^a = 0.5\pm$. The pattern of convergence to one of the types also occurred, but typically somewhat slower, when simulating the purely stochastic exogenous τ_t^i's (as mentioned earlier in footnote 24).

Second, the main insight from the simulations highlights the possibility of irregular preference shift cycles, manifested in a sequence of interior values for the fraction of types which does not converge to any of the two corner steady states, even sometimes after 1000 generations, as illustrated in many figures of our supplement. The conditions which lead to such dynamics are the following two: (i) the endogenous vertical probability differential should be relatively low (about or less than 0.1 or 0.2 in absolute value); and (ii) the initial fraction should be close to the mid-point, $q_0^a \approx q_0^b$. The first condition appears to be the more influential one, unless the fractions of types are too distant. The second condition is of interest as it potentially facilitates reversals at irregular intervals in the voted degree of CBI too, that is, when the institutionalization channel is also operative, in addition to the socialization channel. For that particular reason we illustrate the flavor of our simulation results selecting exactly the case of $q_0^a = 0.5+$ in the supplement.

Hence, as the simulations confirmed, our mechanism of endogenous preference transmission in a stochastic set-up where generations learn and adapt provides an alternative (under certain parametrizations) to the assumption of cultural substitution. Interior equilibria with both types perpetuating across time (and not vanishing) were generated by

drift, while with $\rho \to 1$ it approaches random walk with drift. Thus, while modeled and simulated as a stochastic AR(1) with drift, our low-frequency inflation dynamics is rather general though remaining simple.

[28] The simulations also assume a symmetric socialization effort by the two types, in the sense that, for example, when $\tau_t^a(\cdot) = 0.55$ and $\tau_t^b(\cdot) = 0.45$ after an observed increase in the conditional mean of inflation, then $\tau_t^b(\cdot) = 0.55$ and $\tau_t^a(\cdot) = 0.45$ after an observed decrease in the conditional mean of inflation: this results into the low endogenous vertical probability differential case (illustrated in the supplementary appendix) where $\left|\tau_t^a\left[e_t^a\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] - \tau_t^b\left[e_t^b\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right]\right| = 0.1$.

[29] The figures collected in the supplementary appendix summarize our most interesting results.

explicitly modeling the response of parents in their socialization effort to the change in the conditional mean of inflation they have observed. The extension of the Bisin–Verdier (2001) – Sáez-Martí–Sjögren (2008) framework along such lines we provided appears essential and insightful, as well as consistent with the model we proposed in section 2. Our theoretical contribution to the literature thus consists in showing how the endogenous transmission of inflation preferences and monetary institutions in a stochastic economic environment can be understood as a process of intergenerational learning from history.

4 Empirical Evidence

The theory we developed and simulated thus far highlights a key determinant of the long-run evolution of inflation aversion. It is the proportion (q_t^a) of more inflation-averse (type-a) agents relative to the proportion (q_t^b) of less inflation-averse (type-b) agents in the population. q_t^a and q_t^b evolve across generations driven by socialization efforts ($\tau_t^a \left[e_t^a\left(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot\right), \cdot\right]$ and $\tau_t^b \left[e_t^b\left(\widehat{\pi}_t - \widehat{\pi}_{t-1}, \cdot\right), \cdot\right]$) of parents with respect to their children and by institutional amendments that constrain policies (when agents vote to implement their preferences, G_t^{a*} or G_t^{b*}). We showed that both these preference transmission channels, socialization and institutionalization, can be thought of as ultimately shaped out by generational learning from inflation history, whereby each generation updates the conditional mean of the low-frequency inflation process ($\widehat{\pi}_t$).

4.1 Measuring Inflation Aversion

Inflation aversion data spanning generation-long periods are not available. We thus have to resort to cross-section estimates in assessing the impact of the determinants of inflation aversion highlighted by our theory.

Our measure of inflation aversion is based on the International Social Survey Program (ISSP) conducted by the Inter-university Consortium for Political and Social Research, which collects nationally representative data in a way that is comparable across countries. We employ the 2006 wave, the latest, of the survey on the role of government in society (Role of Government, wave IV, hereafter RoG IV). It provides us with a sample of 33 countries and a corresponding database containing answers to questionnaires from individuals. To measure inflation aversion, we rely on the following question (7b): *On the whole, do you think it should or should not be the government's responsibility to keep prices under control?* The six categories of answers proposed to the respondents are: 'definitely should be', 'probably should be', 'probably should not be', 'definitely should not be', 'can't choose' and 'no answer'.[30] We use hereafter the sum of the percentage

[30] Unfortunately, the ISSP RoG 2006 (as well as earlier) surveys do not contain any questions regarding central banks. We, therefore, had to consider the government and the central bank (in each of the countries in our sample) as constituting the same public-sector macroeconomic – monetary, in particular – authority. While it is true that the intertemporal public-sector budget constraint would include both institutions as its aggregate (or consolidated) unit of relevance, we acknowledge the potential limitations of such an interpretation.

shares of the first two categories as our new measure of a country's degree of inflation aversion employed in the regressions. We, in effect, have constructed a survey-based proxy of 'absolute' inflation aversion in the population, which is different from the few other measures one can find in the literature.[31]

[Table 1 about here]

Table 1 collects descriptive statistics concerning our measure of absolute inflation aversion. A striking finding is that all countries in the ISSP RoG IV sample are highly inflation-averse. On average, 86.4% of the respondents reply that governments should definitely or probably control prices. The countries are almost equally distributed in the three upper quartiles, with the standard deviation for the whole sample being 8.3, or 10% of the average, a significant degree of variation which deserves to be explained.

4.2 Explaining Inflation Aversion

As Shiller (1997) notes, even more important than the international differences in inflation aversion are the intergenerational ones. Since the 1960s, demographic changes have been tremendous, as a large generation of baby-boomers is now entering into its retirement period. Such an intergenerational preference shift could have remained unnoticeable except for the size of this aging group within the current adult generation, which has enabled baby-boomers to translate their preferences into policies (see, e.g., Farvaque et al., 2010, for related evidence on the reduction in inflation). Thus, an obvious candidate to proxy type-a agents in our model is the share of retirees in the mature population, while the working age people could be our proxy for type-b agents in the mature population. We examined how retirees and workers responded to the ISSP 2006 RoG IV question 7b. Comparing the responses by these two categories of the adult generation confirmed that retirees are, generally across our sample, more inflation-averse than people of working age. Therefore, a first long-run determinant of the degree of inflation aversion in our cross-sectional empirical tests of the theory is the proportion of retirees in the population. As one check for robustness, we employ both the share of retirees (i.e., our proxy for q_t^a) and the ratio of the share of retirees to the share of working age population (q_t^a/q_t^b) in alternative specifications. These variables, to serve as the regressor of main interest, summarize the preference structure of the theoretical economy described in the preceding sections.

In the model as well as in real life, evolving inflation aversion perceptions across generations can be translated, and should have been largely embodied, into the degree of

[31] Scheve (2004) and Jayadev (2006) have also analyzed data from the ISSP, but from the preceding wave (ISSP RoG III, run in 1996). They both made use of a measure of 'relative' inflation aversion, employing a different question, where respondents were asked if the government's priority should be to fight unemployment or inflation. Another available measure of inflation aversion is an index constructed by Krause and Méndez (2005) and employed in Krause and Méndez (2008) for 34 countries over a period of 24 years. Their index is also defined as a relative degree of inflation aversion, and it aims at revealing policymakers' preferences. It measures the weight a policymaker puts on inflation stabilization in an objective function optimized under short-term (i.e., business-cycle like) constraints.

CBI a nation has instituted at any particular period of its history. And here is where the key implications of our OLG set-up allow a test of the theory in the available ISSP RoG IV cross-section of 33 countries, representing regional and socioeconomic types from all over the world. Moreover, during the last two decades at least, granting more independence to the monetary authority from the government has been econometrically shown to bear strongly on inflation (see, among others, Brumm, 2002, and de Haan and Klomp, 2008). Following such theoretical and empirical results and capturing our institutionalization channel of preference transmission, we include in the control set an index of CBI. Since our data on inflation aversion is from 2006, we opt for the CBI index computed by Arnone et al. (2009) for 2003, the closest available year.

Yet, our cross-section also includes emerging markets. In these countries, studies on CBI have consistently shown that indexes based on legal aspects are not always statistically significant. To deal with this issue, the literature generally makes use of the turnover of central bankers (see, for example, Dreher et al., 2008). Employing such a proxy in our framework would however be orthogonal, since turnover ratios are by definition related to short-term issues.[32] Hence, to account for the fact that the rule of law is as important as the legal independence of the central bank, we include a measure of the protection of property rights, developed by the Heritage Foundation and now regularly considered as a reliable way to capture the respect for the law (see, for example, La Porta et al., 2004).

Finally, to proxy the socialization channel in our model which would also operate through transmitting the impact of recent generation experiences – in particular, with high inflation, we add to the regressors a dummy. It equals 1 when episodes of hyper- or high inflation have been known in the 20th century, using the classification in Fischer et al. (2002).

Consequently, our benchmark cross-section equation is of the form:

$$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t.$$

InflAvers is our measure of a nation's degree of (absolute) inflation aversion, and *Retirees* is the share of retirees in the population or – depending on the regression specification – the ratio of the share of retirees to the share of working age population. *HighInflDum* is the dummy representing past (high) inflation experiences, *CBI* is the CBI index, *PropRs* stands for the property rights index, and ϵ is the error term. The equation is estimated by weighted least squares (WLS). WLS is a natural choice since our ISSP 2006 RoG IV sample includes countries as small as Ireland or Slovenia and as big as the US, Japan or Russia, in terms of both population and real GDP (which we choose as our two alternative weighting vectors). In the regressions weighted by the population, we also controlled for the effect of the country being richer or poorer, by employing the real GDP per capita, $RGDPpc_t$, for 2004 (from the World Penn Tables 6.2, see Heston et al., 2006).

[32] Nevertheless, robustness checks using such a measure found it not statistically significant in our sample (see below).

[Figure 4 about here]

We performed the usual diagnostics tests involving the residuals from the regressions. In particular, we experimented as well with OLS, and analyzed the residuals of both the OLS and WLS regressions. This is documented in Figure 4 for one of our main specifications (namely, 1.1 in Table 2 further down). It is clear from the OLS residual plot and histogram (upper panels in Figure 4) that the OLS residuals manifest heteroskedasticity as well as non-normality. Since large residuals were, roughly, inversely proportional to population size (evident also in the plots), we first conjectured that the heteroskedasticity we were dealing with was of such known form. This induced us to rely on WLS instead of OLS. While the WLS residuals still displayed heteroskedasticity, the Jarque-Bera test (see the bottom right histogram in Figure 4) could not reject their normality. However, the results from formal White tests for the presence of heteroskedasticity of unknown form were inconclusive with respect to both the OLS and WLS residuals in most of our various specifications. We therefore implemented further estimation with White correction for heteroskedasticity of unknown form in our WLS regressions under both alternative weighting schemes.

The benchmark results from our estimation are presented in Table 2. The weighting vector consists of the respective population by country, data for 2004 (from the World Penn Tables 6.2, see Heston et al., 2006).

[Table 2 about here]

To better capture the model's two degrees of inflation aversion in a compact form (type-a preferences relative to type-b preferences), regression 1.1 uses the ratio of the share of retirees to the share of workers as the key regressor of interest. The controls include real GDP per capita, the high inflation dummy, the CBI index, and the property rights index. All variables and the intercept are statistically significant: real GDP per capita at the 10% level, the property rights index at the 5% level, the remaining three regressors and the constant at the 1% level. Furthermore, all have signs in conformity with theoretical expectations, and the explanatory power of the regression is very high. Our theory is empirically corroborated, as the higher the share of retirees relative to the working age population, the higher is a country's inflation aversion. As expected, it turns out that historical experience with high inflation (our dummy) negatively impacts current inflation aversion. That is, high inflation in the past leads the contemporaneous generation to take steps (through socialization of their children and possibly also through institution-building by majority voting) to avoid returning to such a damaging path.[33] Consequently, the current generation (their children) feels institutionally more protected from inflation, and their inflation aversion is reduced. This is confirmed as well by the

[33] To check robustness, we also ran the regressions substituting the high inflation dummy of Fischer et al. (2002) with two alternative high inflation dummies. They were constructed as 2- and 3-digit recent 15-year average of inflation. Our estimates showed very similar results in terms of the statistical significance, signs and even magnitudes of the coefficients for all included variables (as those reported in Table 2).

negative sign of the CBI index coefficient, showing that higher CBI reduces a nation's inflation aversion. We again interpret this in the sense of our theoretical model that when agents are protected by a higher degree of institutionalized CBI, they feel less threatened by inflation and are thus less wary of it.[34]

To check for the potential joint importance of socialization, as captured by the high inflation dummy, and institutionalization, being enshrined in the indexes for CBI or the rule of law, we interacted all possible combinations of these three regressors. We could not obtain statistical significance of such product terms most of the time, which we illustrate by the findings in regression 1.2. The justification for experimenting with these interaction terms in the regressions arises from the following causality, also implied by our theoretical model. If a country experiences high inflation, the degree of a society's inflation aversion will increase, as b-types (less inflation-averse) switch to a-types (more inflation-averse). I.e., up to this point, it is only the socialization channel of preference transmission that operates, and this channel is always effective. Once such changes in the structure of aggregate preferences surpass a particular critical mass, the median voter in the model, simple voting majority obtains: only now the institutionalization channel becomes effective too, and if the a-types have not been able to enshrine legally their preferences in earlier generations, they do it at this point in time. The degree of CBI institutionalized by a-types then remains valid until the opposite change of majority, in case this happens (sooner or later) in the future. Meanwhile, this higher (type a preferred) degree of inflation aversion built-in into the current law acts also as an 'insurance device' against excessive actual inflation, possibly decreasing the socialization effort of a-types.

One minor inconvenience of regressions 1.1 and 1.2 is that we cannot obtain a more precise, quantitative interpretation concerning the marginal effect of the more inflation-averse type (type-a, as per our theory) on the degree of a society's inflation aversion. To be able to judge about that, as well as to check robustness, we proceed to regression 1.3 by considering separately the shares of the retirees and the working age population, and not their ratio. This specification highlights two insightful results. First, it is the share of retirees that remains statistically significant in determining inflation aversion, but not the share of the working age population. This is not much surprising given the predictions of our model as well as the demographic evolutions the world has known in the last decades. Second, we can now see that an increase of one percentage point in the share of retirees leads to an increase of almost half percentage point (to be precise, 42 basis points) in the degree of inflation aversion, *ceteris paribus*. This is a very strong marginal impact, much stronger than the comparable (being share-measured variables) marginal impact – in the

[34] To address another limitation of our data arising from potential skepticism of private agents about the goverment stabilizing prices, we constructed an index of the degree of trust in the government, making use – for consistency – of survey responses collected from the same data source, the ISSP RoG 2006. We aggregated the % of the responses within the top two categories from question 17 in this survey: *In your opinion, about how many politicians in [Country] are involved in corruption?*, with the following possibilities: "almost none; a few; some; quite a lot; almost all; can't choose". We then ran regressions adding this government trust index to our explanatory variables in Table 2. The added measure of trust in the government did not appear as statistically significant.

opposite, negative direction – of the CBI index (of about -15 basis points). Regression 1.4 finally adds the same interaction term as in regression 1.2, which – again – is not significant.

To check robustness, we altered the weighting vector, using real GDP instead of population. In this second weighting scheme we also had to omit one of the controls in the first weighting scheme, namely, real GDP per capita, to avoid potential inference problems with the used weights. Insofar this variable showed up as significant, but with practically zero coefficient in the preceding set of results, such an omission does not weaken the estimation. Table 3 shows the results from the WLS implementation with real GDP weighting.

[Table 3 about here]

As can be seen from the table, the change in the weighting vector does not affect in any important way our findings, neither qualitatively nor quantitatively. Again, adding the interaction term for the combined effect of the high inflation dummy and the CBI index in specification 2.2 does not strengthen the regression output.

Specifications 2.3 and 2.4 in Table 3 confirm the two important findings of the analogous regressions, 1.3 and 1.4, in Table 2. First, the share of retirees remains statistically significant in determining inflation aversion, but not the share of the working age population. And, second, an increase of one percentage point in the share of retirees leads to an increase of (a bit higher or lower than) half percentage point in the degree of inflation aversion, *ceteris paribus*. Thus, the marginal impact of the share of retirees on the degree of a society's inflation aversion comes out as even slightly stronger in magnitude when using real GDP weights instead of population weights. Moreover, it also remains about three times higher (in absolute value) than the comparable (statistically significant) effect of the CBI index (of about -13 basis points).

[Tables 4, 5, 6 and 7 about here]

In further robustness checks, we ran a few modifications of our regressions 1.1 and 1.3, presented in tables 4, 5, 6 and 7. First, given our model assumption (supported by the dominant evidence) that actual inflation tends to be negatively correlated with CBI, one competing interpretation of the negative correlation between the CBI index and inflation aversion we robustly found could be that recent inflation and inflation aversion may be themselves positively correlated. Moreover, survey respondents may have the current inflation in mind, which could affect the measure of inflation aversion. In order to test such alternative interpretations, we replaced the CBI index with recent average inflation, measured as the mean annual rate of CPI inflation in the five-year period up to and including 2006, the year of the wave (IV) of the ISSP RoG we are working with. Intuitively, the respondents could have been less inflation-averse if inflation has recently (in the run-up to the survey year) been low. The recent average inflation rate, however, came out robustly as not statistically significant, which excludes the possible alternative interpretation and reinforces the one we proposed above. Second, as we saw, the high inflation dummy is not significant in many of the various specifications where the CBI index always enters as well, and in the specifications with their interaction term. To see to what extent the statistical significance of the CBI index throughout our regressions may have invalidated the statistical significance of the high inflation dummy in separation (and/or of their interaction term), we ran regressions 1.1 and 1.3 with including, alternatively, either the high inflation dummy without the CBI index or vice versa, under our two weighting schemes: see again the reported sensitivity analysis in tables 4, 5, 6 and 7. Both variables were statistically significant and had the right negative sign in (almost) all occasions when each entered the regressions without the other one. This suggests the presence of the two channels we analyzed in the theoretical part, in the sense that inclusion of the (always significant) CBI index reduces the significance level of the high inflation dummy. Our empirical finding of these two particular regressors being correlated is in line with our theoretical set-up: namely, past experience with high inflation matters, as it leads to higher inflation aversion and, hence, higher CBI, with the ultimate result in our data that both regressors could potentially explain inflation aversion.[35]

5 Concluding Comments

In this paper we address the question of what drives the long-run evolution of inflation preferences and monetary institutions. To do so, we extend the OLG framework of Bisin and Verdier (2000, 2001), appropriate to study endogenous transmission of beliefs and norms across generations. We, in effect, modify their set-up to explore endogenously derived and transmitted inflation preferences, dropping the assumption of cultural substitution and replacing their deterministic model with a dynamic-stochastic environment of adaptive learning. In the simplest cases, also examined in the earlier literature, where the vertical transmission probabilities are either (i) exogenously fixed or (ii) endogenous but deterministic, there is a clear 'separation' of results. In the first case, only one of the types survives while the other is extinguished, and convergence depends on what we referred to as the direction and the speed of changes in the structure of the population. In the second case, convergence to an interior equilibrium with both types surviving is achieved at the cost of assuming cultural substitution. Our theoretical contribution is to show that, if the vertical transmission probabilities are a function of parent socialization efforts in response to observed changes in the conditional mean of inflation between successive generations, our model generates much richer dynamics. It is characterized by switching majorities and phases of high and low degree of inflation aversion in the population and corresponding degree of legislated monetary control we interpreted as CBI, fluctuating around an interior equilibrium for long, or forever (depending on initial conditions and

[35] Further analysis of our empirical results in the light of our inflation aversion measure by region of the world is provided in the supplementary appendix.

the properties of the assumed shock processes).

We then propose appropriate empirical tests of our theory, making use of a novel, own measure of a nation's inflation aversion constructed out of survey data. We report robust cross-section evidence that a country's demographic structure, in particular the variation in the share of retirees (our proxy for the more inflation-averse type, as our model and data suggested) or of their ratio to the share of workers (our proxy for the less inflation-averse type), is a key driver of social preferences with regard to inflation. The presented regressions also confirm the importance of two other major long-run determinants of inflation aversion consistent with our model, namely, experience with past high inflation transmitted through socialization and the degree of CBI embodied in evolving monetary institutions. Our econometric findings, thus, broadly support our analytical framework and simulation results.

The model could be extended in several directions. On the theoretical side, allowing for population growth, alternative modeling of the endogenous types and/or higher heterogeneity of traits could provide valuable insights, as well as the examination of different processes guiding low-frequency inflation dynamics. On the empirical side, another implementation compatible with slight modifications of the theory we proposed would be to consider how the evolution of the proportions of net savers and borrowers in an economy can influence its degree of inflation aversion, provided data become available on a comparable cross-country basis.

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inflation aversion	mean	median	max	min	quant.	s. d.	skew.	kurt.	obs.
[60, 70)	0.674	0.674	0.674	0.674	0.674	–	–	–	1
[70, 80)	0.770	0.773	0.796	0.702	0.773	0.027	-1.96	5.83	9
[80, 90)	0.860	0.865	0.897	0.825	0.865	0.025	0.01	1.90	10
[90, 100)	0.946	0.937	0.980	0.910	0.937	0.023	0.07	1.54	13
all	0.864	0.870	0.980	0.674	0.870	0.083	-0.41	2.23	33

Table 1: Inflation Aversion – Descriptive Statistics by Quantile

Source: Authors' calculations based on ISSP 2006 RoG IV.

Regression	1.1	1.2	1.3	1.4
intercept	1.1090***	1.0531***	0.9687***	1.0490***
	(0.0000)	(0.0000)	(0.0012)	(0.0048)
retirees/workers	0.3007***	0.3223***	–	–
	(0.0012)	(0.0002)	–	–
retirees share	–	–	0.4157***	0.4654**
	–	–	(0.0083)	(0.0168)
workers share	–	–	0.2146	0.0187
	–	–	(0.6079)	(0.9748)
real GDP pc	$-2.81\cdot10^{-6}$*	$-4.89\cdot10^{-6}$**	$-3.55\cdot10^{-6}$	$-4.82\cdot10^{-6}$**
	(0.0650)	(0.0418)	(0.1326)	(0.0378)
high inflation dummy	–0.0336***	0.0644	–0.0441**	0.0473
	(0.0009)	(0.3344)	(0.0299)	(0.6874)
CBI index	–0.1524***	–0.1144***	–0.1542***	–0.1234**
	(0.0028)	(0.0091)	(0.0031)	(0.0226)
property rights index	-0.1868**	-0.0696	-0.1522	-0.0724
	(0.0364)	(0.6165)	(0.1909)	(0.5728)
CBI × high inflation	–	-0.1537	–	-0.1312
	–	(0.1596)	–	(0.4124)
adjusted R^2	0.9342	0.9386	0.9344	0.9353
F-statistic p-value	0.0000	0.0000	0.0000	0.0000

Table 2: Determinants of Inflation Aversion – Population-WLS Estimates

Note: Coefficients estimated by WLS using 2004 population weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \lambda RGDPpc_t$

$+\gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t$.

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	2.1	2.2	2.3	2.4
intercept	1.0884***	1.1479***	1.2496*	1.1571
	(0.0000)	(0.0000)	(0.0523)	(0.1195)
retirees/workers	0.3946***	0.3132*	–	–
	(0.0001)	(0.0746)	–	–
retirees share	–	–	0.5708***	0.4596*
	–	–	(0.0000)	(0.0684)
workers share	–	–	–0.2294	–0.0089
	–	–	(0.7982)	(0.9941)
high inflation dummy	–0.0186	–0.1043	–0.0178	–0.1129
	(0.1635)	(0.3395)	(0.1745)	(0.5305)
CBI index	–0.1378***	–0.1501***	–0.1355*	–0.1590
	(0.0092)	(0.0071)	(0.0952)	(0.1530)
property rights index	–0.3179***	–0.3573***	–0.3255***	–0.3525***
	(0.0000)	(0.0001)	(0.0007)	(0.0000)
CBI × high inflation	–	–0.1134	–	0.1256
	–	(0.4347)	–	(0.5990)
adjusted R^2	0.8962	0.8960	0.8913	0.8911
F-statistic p-value	0.0000	0.0000	0.0000	0.0000

Table 3: Determinants of Inflation Aversion – Real GDP-WLS Estimates

Note: Coefficients estimated by WLS using 2004 real GDP weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t$.

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	1.1.A	1.1.B	1.1.C
intercept	0.9768***	1.0559***	1.0976***
	(0.0000)	(0.0000)	(0.0000)
retirees/workers	0.5599***	0.4317***	0.2216**
	(0.0004)	(0.0004)	(0.0128)
real GDP pc	$-4.02 \cdot 10^{-6}$*	$-2.23 \cdot 10^{-6}$	$-2.92 \cdot 10^{-6}$**
	(0.0289)	(0.2189)	(0.0767)
high inflation dummy	–0.0861***	–0.0503***	–
	(0.0047)	(0.0049)	–
CBI index	–	–	–0.1803***
	–	–	(0.0013)
property rights index	–0.1856*	–0.3071***	–0.1292
	(0.0690)	(0.0016)	(0.1448)
recent inflation	0.0065*	–	–
	(0.0789)	–	–
adjusted R^2	0.9103	0.9007	0.9234
F-statistic p-value	0.0000	0.0000	0.0000

Table 4: Determinants of Inflation Aversion – Sensitivity Checks on Regression 1.1

Note: Coefficients estimated by WLS using 2004 population weights from Heston et al. (2006) for:

$$InflAvers_t = \alpha + \beta Retirees_t + \lambda RGDPpc_t$$
$$+ \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \kappa RInfl_t + \epsilon_t.$$

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	1.3.A	1.3.B	1.3.C
intercept	0.9473**	0.9070**	1.1791***
	(0.0181)	(0.0154)	(0.0001)
retirees share	0.7898**	0.6028***	0.3528*
	(0.0112)	(0.0073)	(0.0861)
workers share	0.0586	0.2266	-0.1233
	(0.9249)	(0.6778)	(0.7518)
real GDP pc	$-4.24{\cdot}10^{-6}$*	$-3.08{\cdot}10^{-6}$	$-2.71{\cdot}10^{-6}$
	(0.0937)	(0.2674)	(0.2992)
high inflation dummy	–0.0875**	–0.0622***	–
	(0.0165)	(0.0346)	–
CBI index	–	–	–0.1806***
	–	–	(0.0021)
property rights index	–0.1782	–0.2676**	–0.1398
	(0.1241)	(0.0430)	(0.3463)
recent inflation	0.0056	–	–
	(0.2007)	–	–
adjusted R^2	0.9037	0.8981	0.9207
F-statistic p-value	0.0000	0.0000	0.0000

Table 5: Determinants of Inflation Aversion – Sensitivity Checks on Regression 1.3

Note: Coefficients estimated by WLS using 2004 population weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \lambda RGDPpc_t$
$+\gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \kappa RInfl_t + \epsilon_t.$

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	2.1.A	2.1.B	2.1.C
intercept	1.0725***	1.0550***	1.0856***
	(0.0000)	(0.0000)	(0.0000)
retirees/workers	0.4389	0.4741***	0.3657**
	(0.1539)	(0.0003)	(0.0000)
high inflation dummy	–0.0861	–0.0414***	–
	(0.1670)	(0.0023)	–
CBI index	–	–	–0.1592***
	–	–	(0.0000)
property rights index	–0.4209***	–0.4118***	–0.2916
	(0.0000)	(0.0000)	(0.0000)
recent inflation	–0.0011	–	–
	(0.8661)	–	–
adjusted R^2	0.8593	0.8639	0.8953
F-statistic p-value	0.0000	0.0000	0.0000

Table 6: Determinants of Inflation Aversion – Sensitivity Checks on Regression 2.1

Note: Coefficients estimated by WLS using 2004 real GDP weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t$
$+ \delta CBI_t + \eta PropRs_t + \kappa RInfl_t + \epsilon_t.$

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	2.3.A	2.3.B	2.3.C
intercept	1.7201**	1.7145***	1.2419*
	(0.0197)	(0.0095)	(0.0501)
retirees share	0.5933	0.5727***	0.5304***
	(0.1988)	(0.0092)	(0.0000)
workers share	–0.9224	–0.9041	–0.2217
	(0.4183)	(0.3053)	(0.8025)
high inflation dummy	–0.0355	–0.0341**	–
	(0.1600)	(0.0344)	–
CBI index	–	–	–0.1557**
	–	–	(0.0349)
property rights index	–0.4493***	–0.4525***	–0.3005***
	(0.0000)	(0.0000)	(0.0008)
recent inflation	0.0005	–	–
	(0.9568)	–	–
adjusted R^2	0.8637	0.8685	0.8908
F-statistic p-value	0.0000	0.0000	0.0000

Table 7: Determinants of Inflation Aversion – Sensitivity Checks on Regression 2.3

Note: Coefficients estimated by WLS using 2004 real GDP weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t$
$+ \delta CBI_t + \eta PropRs_t + \kappa RInfl_t + \epsilon_t$.

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

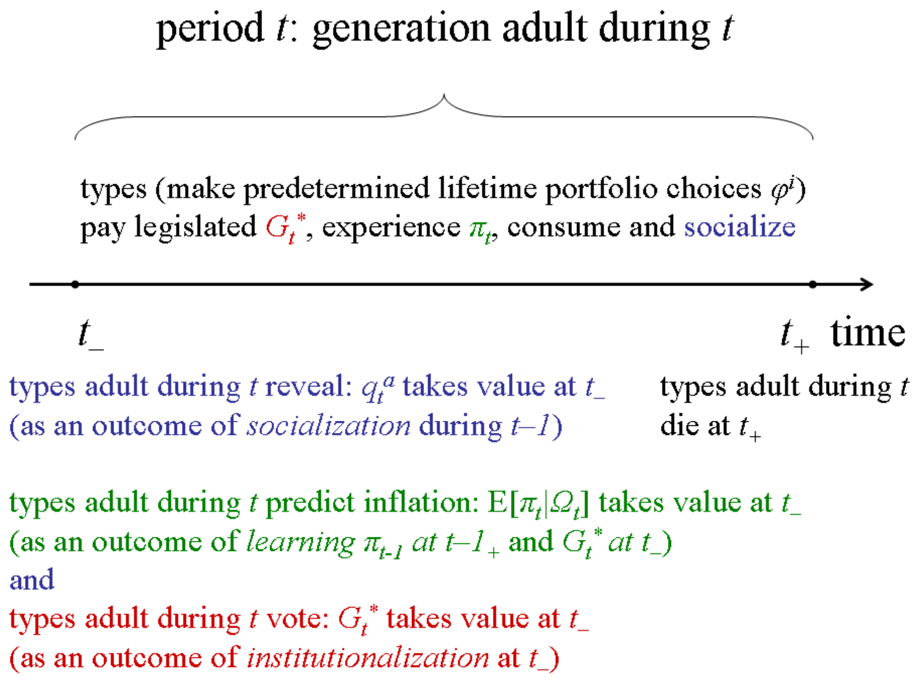

Figure 1: Sequencing of Events in Any Period t

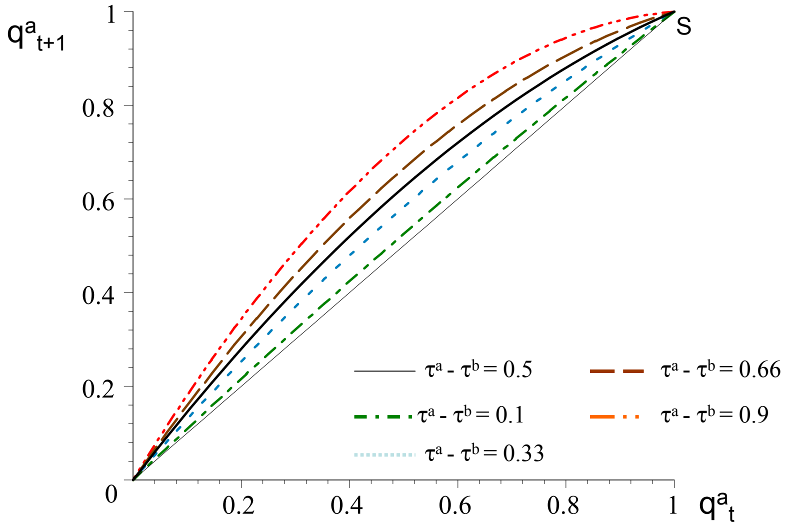

Figure 2: Deterministic Exogenous Convergence to Type-a Preferences (for details and interpretation, see the discussion near the end of subsection 3.1)

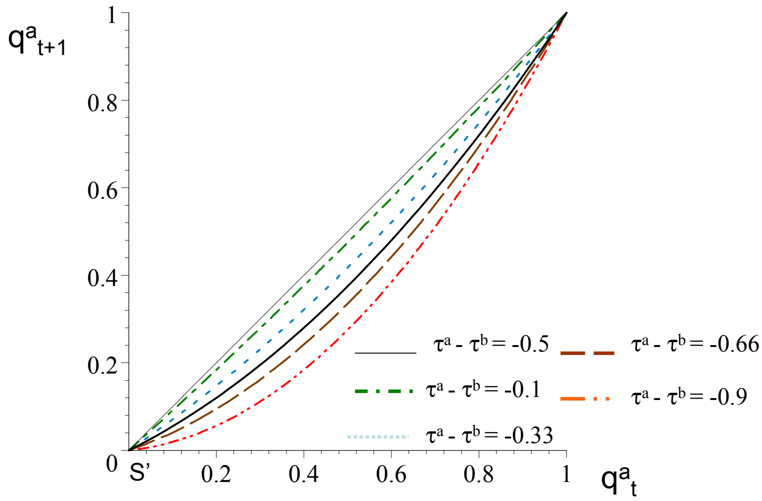

Figure 3: Deterministic Exogenous Convergence to Type-b Preferences (for details and interpretation, see the discussion near the end of subsection 3.1)

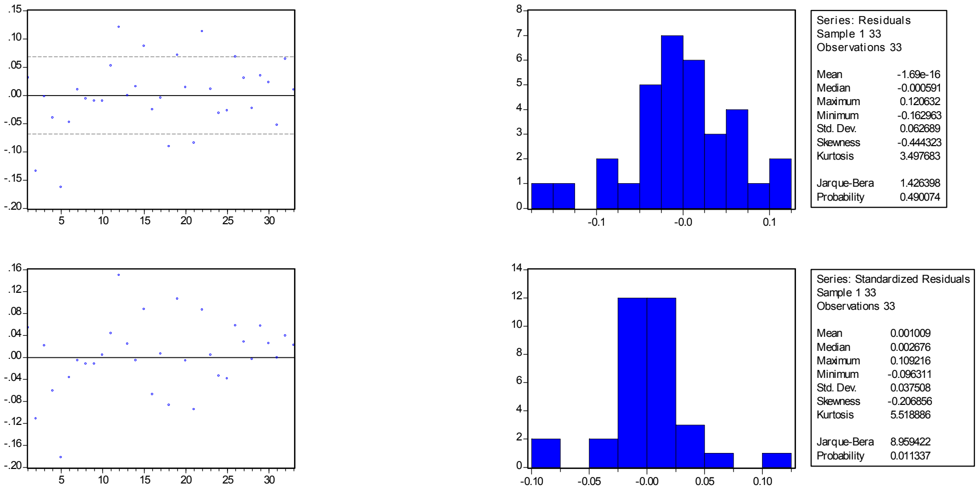

Figure 4: Regression Residuals Analysis – Heteroskedasticity of Residuals from OLS (top left panel) and from WLS (bottom left panel): countries in the sample on the x-axis (1 to 33) in ascending order of population; and Normality of Residuals from OLS (top right panel) and from WLS (bottom right panel)

FOR ONLINE PUBLICATION: Supplementary Appendix

This supplementary appendix provides further details on aspects of our data sources and definitions (section A), our novel measure of inflation aversion (section B), and our simulations (section C). For replication purposes, an additional *.zipx file archive is also available online; it contains our data set, codes and the respective input and output files.

A Data Sources and Definitions

- **Degree of Inflation Aversion**
  - *Source:* International Social Survey Program (ISSP) on the role of government in society (Role of Government, wave IV) conducted by the Inter-university Consortium for Political and Social Research in 2006 for 33 participating countries.
  - *Definition:* authors' computations, summing up the percentage shares of responses falling in the first two categories of answers (*highlighted in Italics* among the enumerated below) to the following question (7b):
    - 'On the whole, do you think it should or should not be the government's responsibility to keep prices under control?'
    - the potential answers proposed to the respondents are:
      - '*definitely should be*';
      - '*probably should be*';
      - 'probably should not be';
    - 'definitely should not be';
      - 'can't choose';
      - 'no answer'.

- **Demography**
  - *Source:* World Bank, *World Development Indicators* (annual series by country: April 2008 and June 2009 issues, accessed via ESDS), for the year 2006; *except for Taiwan* (see below); World Bank staff estimates from various sources including census reports, the United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies, and Macro International.
  - *Definitions:*
    - **population, total** (SP.POP.TOTL);

    - **share of retirees:** Population ages 65 or older (% of older, SP.POP.65 UP.TO.ZS);
    - **share of working age population:** Population ages 15-64 (% of total, SP.POP.1564.TO.ZS).
  - *Source for Taiwan*: authors' computations of the above shares in the total population based on disaggregated data for the year 2000 by age groups from the National Statistics Republic of China (Taiwan); www.eng.stat.gov.tw.

- **Institutions**
  - *Sources:*
    - **central bank independence (CBI) index:** from Arnone et al. (2009), for the year 2003; except for Taiwan: from Ahsan et al. (2008), for the late 2000s;
    - **property rights index:** from The Heritage Foundation, for the year 2009; www.heritage.org;
    - **high inflation dummy:** authors' coding in conformity with Fischer et al. (2002).

- **Macroeconomic Data**
  - *Source: Penn World Table Version 6.2* – see Heston et al. (2006); for the year 2004.
    - **population**;
    - **real GDP per capita**, in PPP-USD;
    - **real GDP**, in PPP-USD**:** authors' computations multiplying the above two numbers.

B Survey-Based Inflation Aversion Index by Region

Putting the empirical results we reported in the article in a regional perspective is another worthwhile way to cross-check their relevance. Table 8 here below organizes our survey-based measure of absolute inflation aversion by region of the world.[36]

[36] Country codes as in the International Social Survey Program (ISSP) on the role of government in society (Role of Government, wave IV), namely: AU: Australia, CA: Canada, CH: Switzerland, CL: Chile, CZ: Czech Republic, DE: Germany, DK: Denmark, DO: Dominican Republic, ES: Spain, FI: Finland, FR: France, GB: Great Britain, HR: Croatia, HU: Hungary, IE: Ireland, IL: Israel, JP: Japan, KR: Korea, LV: Latvia, NL: Netherlands, NO: Norway, NZ: New Zealand, PH: Philippines, PO: Poland, PT: Portugal, RU: Russia, SE: Sweden, SI: Slovenia, TW: Taiwan, US: United States, UY: Uruguay, VE: Venezuela, ZA: South Africa.

inflation aversion									
ADVANCED ECONOMIES (17 COUNTRIES)									
European EMU (7)	FI	FR	DE	IE	NL	PT	ES		
mean: 0.857 (s.d.: 0.076)	0.786	0.828	0.783	0.930	0.796	0.963	0.910		
European non-EMU (5)	DK	NO	SE	CH	GB				
mean: 0.823 (s.d.: 0.053)	0.773	0.895	0.825	0.772	0.852				
non-European (5)	AU	CA	JP	NZ	US				
mean: 0.806 (s.d.: 0.088)	0.868	0.702	0.923	0.769	0.770				
EMERGING MARKET ECONOMIES (16 COUNTRIES)									
European (7)	HR	CZ	HU	LV	PO	RU	SI		
mean: 0.839 (s.d.: 0.094)	0.870	0.674	0.870	0.836	0.780	0.980	0.861		
non-European (9)	CL	DO	IL	KR	PH	ZA	TW	UY	VE
mean: 0.943 (s.d.: 0.026)	0.930	0.967	0.897	0.967	0.958	0.931	0.974	0.923	0.937

Source: Authors' calculations based on ISSP 2006 RoG IV.

Table 8: Inflation Aversion – Descriptive Statistics by Country Groups

First, it appears that countries belonging to the European Monetary Union (EMU) share a higher degree of inflation aversion than the rest of the sample and, interestingly, that this degree is higher than for countries that belong to the European Union (EU), but are not members of the EMU.[37] This tends to show that the adoption of a high degree of independence for the European Central Bank probably has not yet infused the whole population. That institutions do not have immediate impacts, but may need time to establish their credentials, is again in agreement with our model. This latter claim is also confirmed by comparing the inflation aversion levels in Germany and in Russia. Though both countries have suffered from hyperinflation, Germany has since had time to build inflation averse institutions (notably the Bundesbank, before joining the EMU), while Russia's central bank has still not been granted full independence from the government.

Second, and even more interesting is the high degree of inflation aversion in emerging market economies, and particularly among the non-European ones (94.3%), especially once one remarks that the regions where inflation aversion is the highest in our sample are also the ones with the lowest standard deviation. The high level of inflation aversion in these economies can be related to their chronic inflationary experience but weak institutions.

Third, the Czech Republic has the lowest level of inflation aversion in our sample. This can notably be explained by the strong degree of central bank independence of its central bank (0.88, superior to the sample average of 0.72), reinforced over the last decade by the adoption of inflation-forecast targeting. Moreover, most of the countries that have in the past generation span implemented such an inflation targeting regime manifest lower levels

[37] We should be cautious with such interpretations in so far as central bank independence (CBI) in accession countries is not just a matter of social preferences. It is also, or rather, a prerequisite for joining the EMU (and hence the EU as well). Thus being part of the 'acquis communautaire', CBI does not reflect just national preferences in the accession countries (unless one makes the argument that countries would abstain from joining EU in order not to be forced to make their central banks independent).

of inflation aversion (in addition to the Czech Republic, that is the case for Canada, New Zealand, Poland, Sweden, United Kingdom). This tends to show that inflation targeting can back the more institutionalized degree of CBI.[38]

To sum up, in our view this additional analysis of our measure of (absolute) inflation aversion by region summarized above is largely supportive of the model predictions in the article too. It broadly confirms that the underlying evolution of a society's preferences is fundamental to observed macroeconomic trends such as, in our case, cross-sectional inflation aversion variation. This regional perspective also seems to suggest that individuals may vary their socialization efforts to transmit their preferences, depending on the historical and institutional context of learning experiences and the ensuing relative incentives they have to face.

C Illustrative Summary of Simulations

We propose, finally, an illustrative summary of our simulations, described in subsection 3.3 of our article. The summary here only collects a subset of figures capturing 9 key cases of cyclical variation around interior equilibria of the fraction of the more inflation-averse type (type a) over a time horizon of 1000 periods (equal to adult-life generation spans, as per our model). All these 9 cases are characterized by *low* (and constant, in the simulations) *endogenous* (as discussed in subsection 3.3 of the paper) vertical inflation differential, i.e., $\left|\tau^a(\cdot) - \tau^b(\cdot)\right| = 0.1$: this is the case (among those explored in our simulations) most likely to result in convergence to fluctuating interior equilibria. Our illustrative figures present next the alternative parametrizations in these 9 cases (self-explaining from the titles and notes in each of the figures and from the corresponding discussion in subsection 3.3), all starting from an initial condition for $q_0^a = 0.50000001$.[39] We do not show below all analogous 9 cases when allowing for $\left|\tau^a(\cdot) - \tau^b(\cdot)\right| = 0.2$ and the corresponding 9 cases when taking $\left|\tau^a(\cdot) - \tau^b(\cdot)\right| = 0.5$ instead.

In addition, we have simulated over 1000 periods the same $27\,(= 9 \times 3)$ cases of the above paragraph under, alternatively, $q_0^a = 0.49999999$, $q_0^a = 0.25$ and $q_0^a = 0.75$, and these results are available upon request. The respective four (for the four initial conditions for q_0^a) basic underlying R programs (whose parameters can be varied accordingly in replicating the essence of our findings) have been made available online in a *.zipx file archive.

[38] The exceptions (i.e., inflation targeters that show slightly higher degrees of inflation aversion) are Australia and Hungary. Both countries have, however, recently known episodes of strong growth, for the former, or political instability, for the latter, which may have re-ignited inflation scares among the population.

[39] Note that, as we mentioned in the article, the simulation cases where the mean of the inflation shock is assumed zero eliminate, by construction in the codes, the drift term in the low-frequency AR(1) stochastic process for inflation as well as the feedback from the CBI (or institutional) channel.

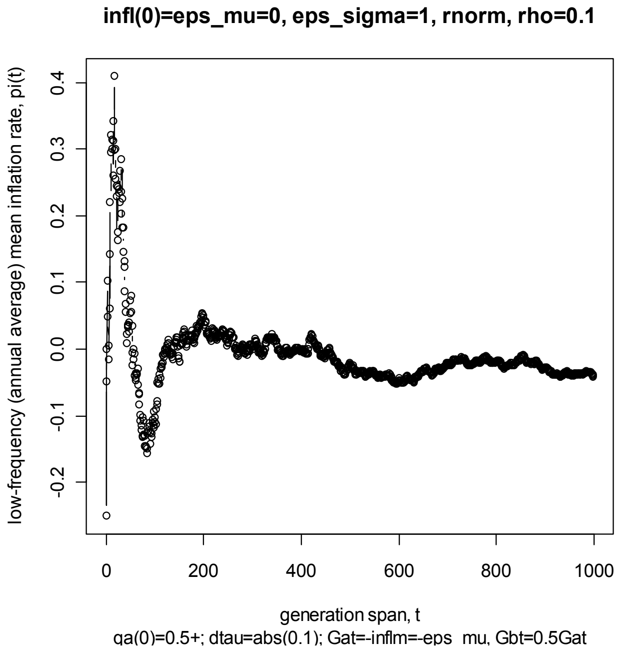

Figure 5: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, low inflation persistence, zero mean and unit variance of the inflation shock

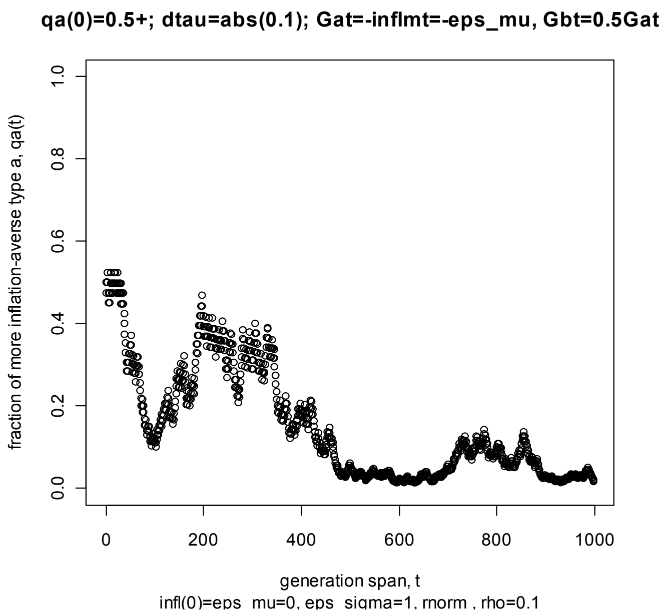

Figure 6: q_t^a dynamics under low vertical transmission differential, low inflation persistence, zero mean and unit variance of the inflation shock

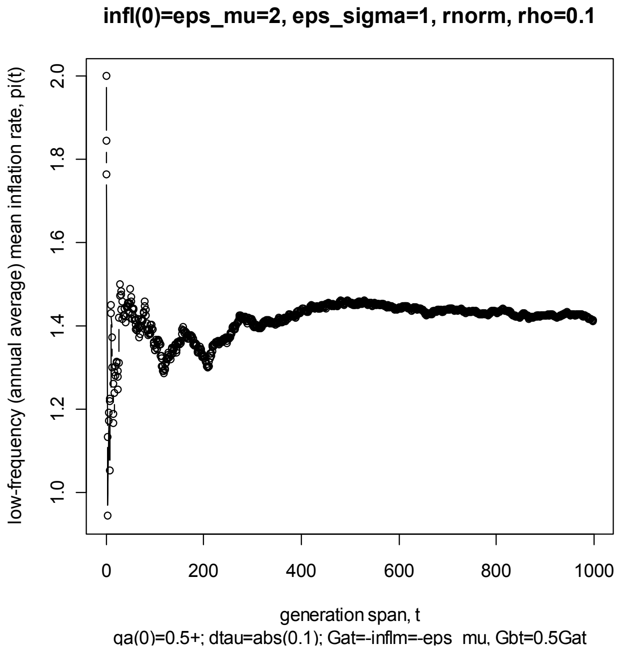

Figure 7: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, low inflation persistence, low mean and unit variance of the inflation shock

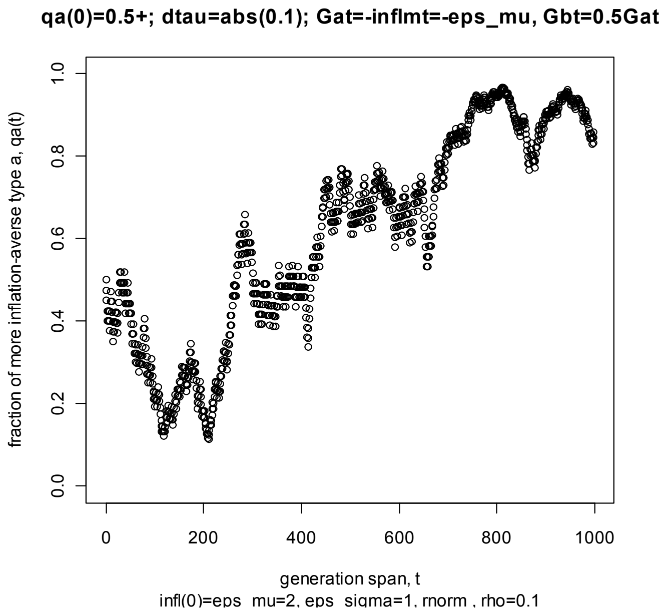

Figure 8: q_t^a dynamics under low vertical transmission differential, low inflation persistence, low mean and unit variance of the inflation shock

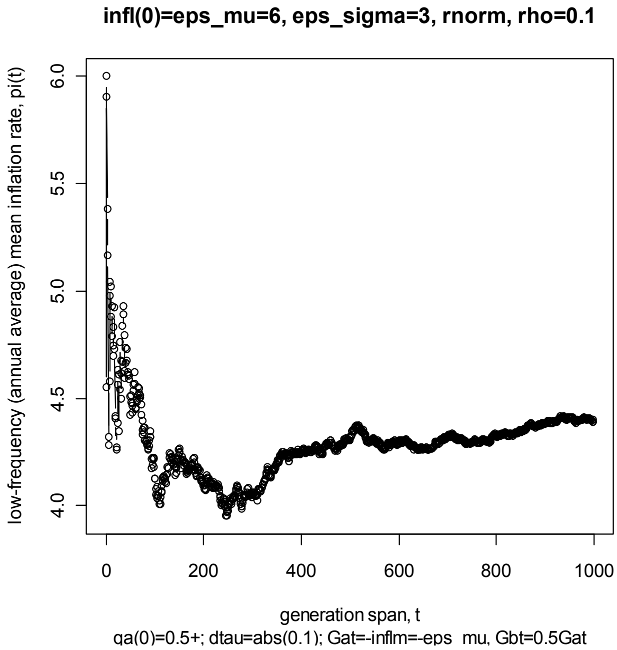

Figure 9: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, low inflation persistence, high mean and high variance of the inflation shock

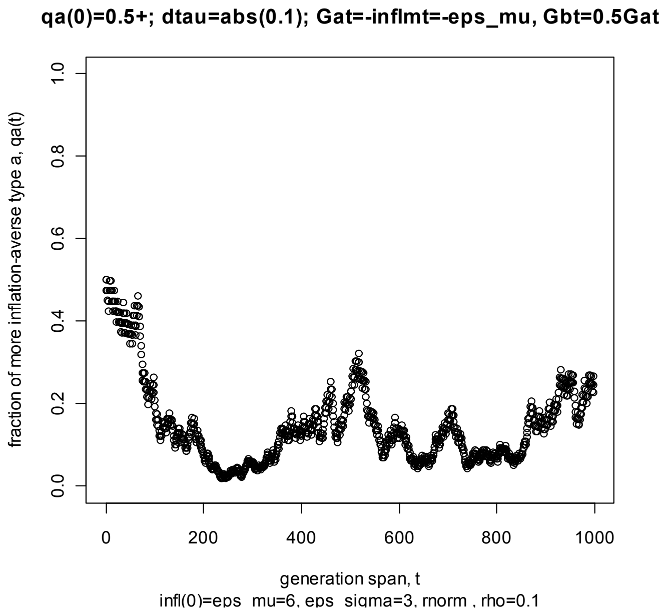

Figure 10: q_t^a dynamics under low vertical transmission differential, low inflation persistence, low mean and unit variance of the inflation shock

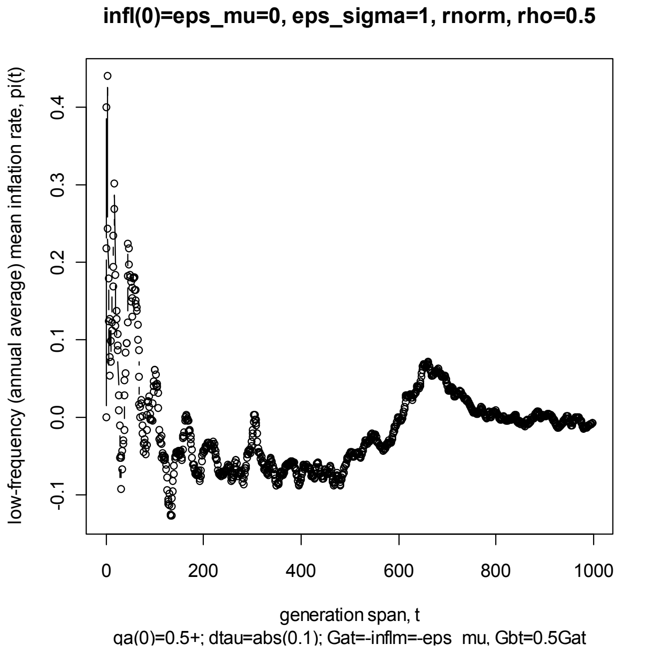

Figure 11: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, moderate inflation persistence, zero mean and unit variance of the inflation shock

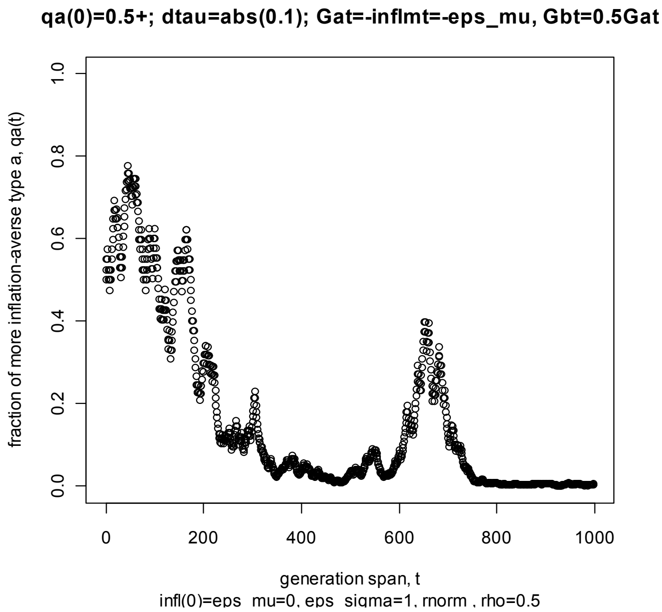

Figure 12: q_t^a dynamics under low vertical transmission differential, moderate inflation persistence, zero mean and unit variance of the inflation shock

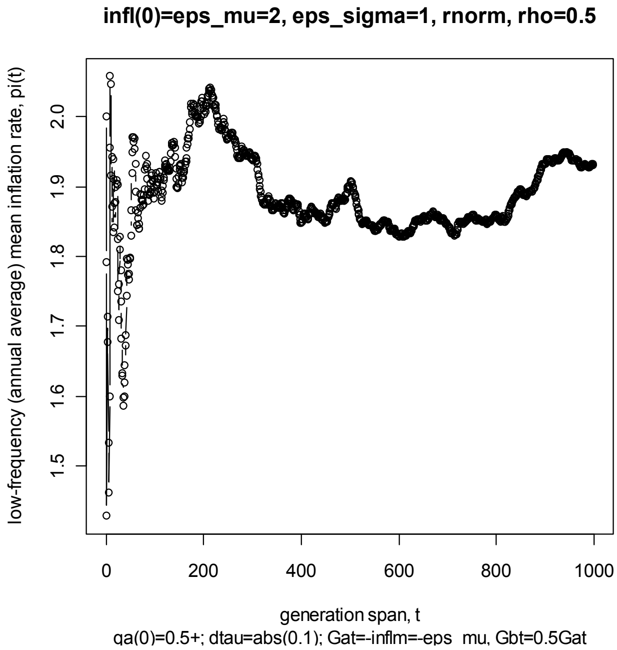

Figure 13: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, moderate inflation persistence, low mean and unit variance of the inflation shock

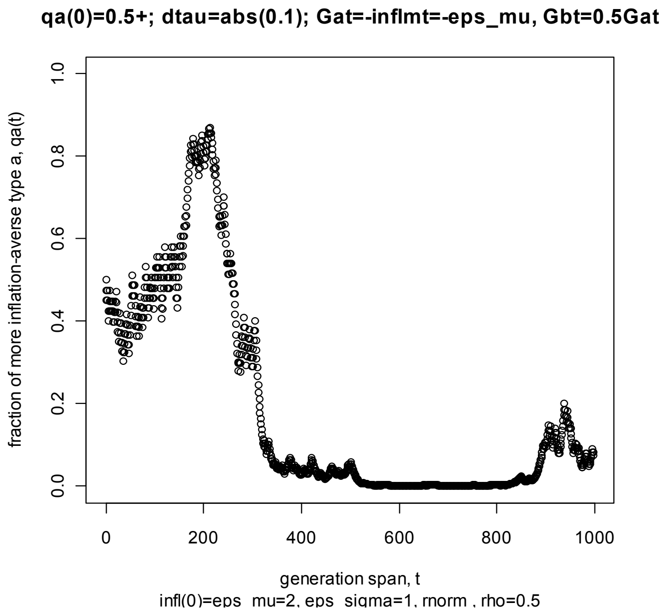

Figure 14: q_t^a dynamics under low vertical transmission differential, low inflation persistence, low mean and unit variance of the inflation shock

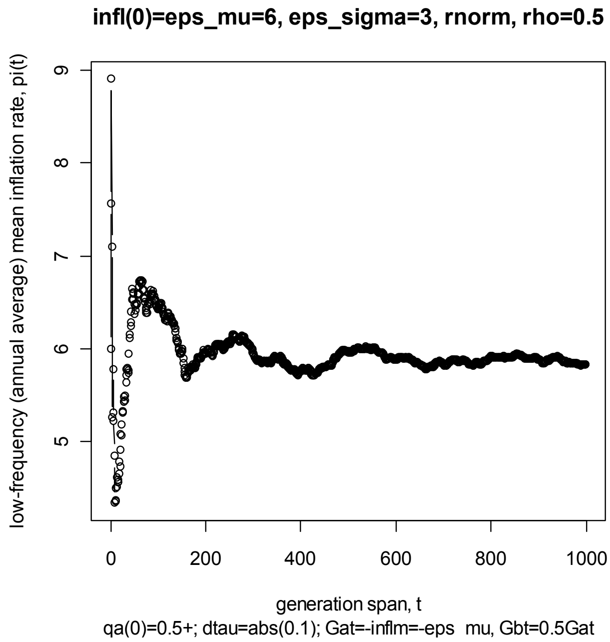

Figure 15: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, moderate inflation persistence, high mean and high variance of the inflation shock

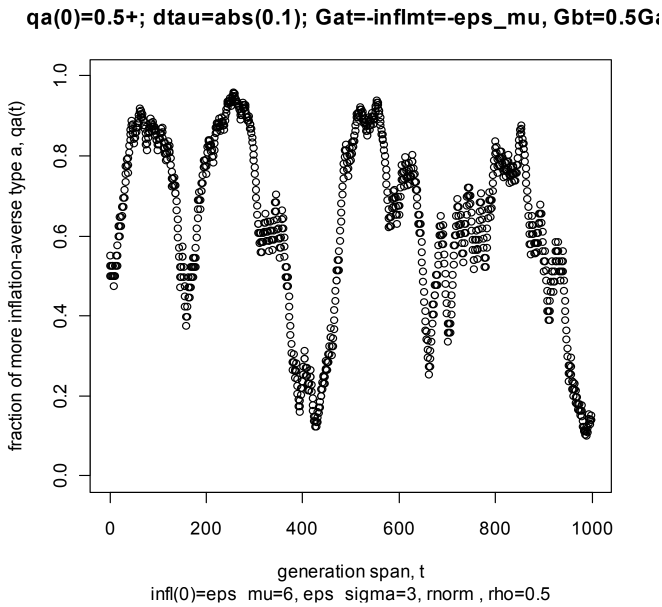

Figure 16: q_t^a dynamics under low vertical transmission differential, moderate inflation persistence, high mean and high variance of the inflation shock

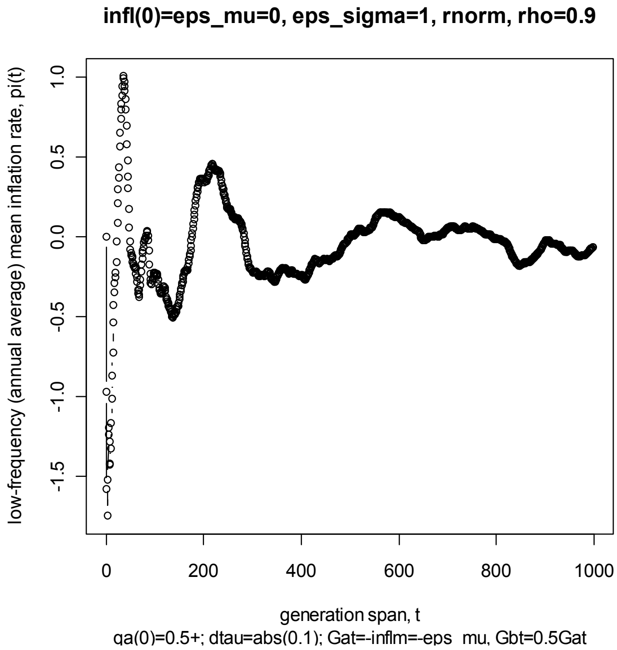

Figure 17: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, high inflation persistence, zero mean and unit variance of the inflation shock

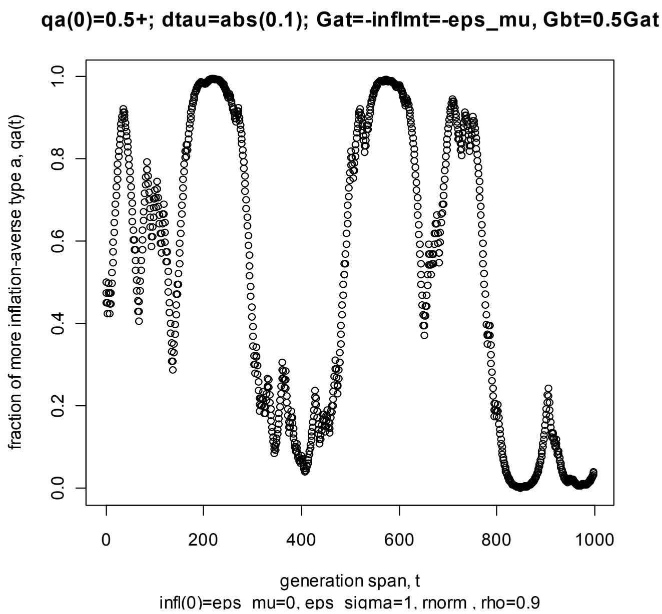

Figure 18: q_t^a dynamics under low vertical transmission differential, high inflation persistence, zero mean and unit variance of the inflation shock

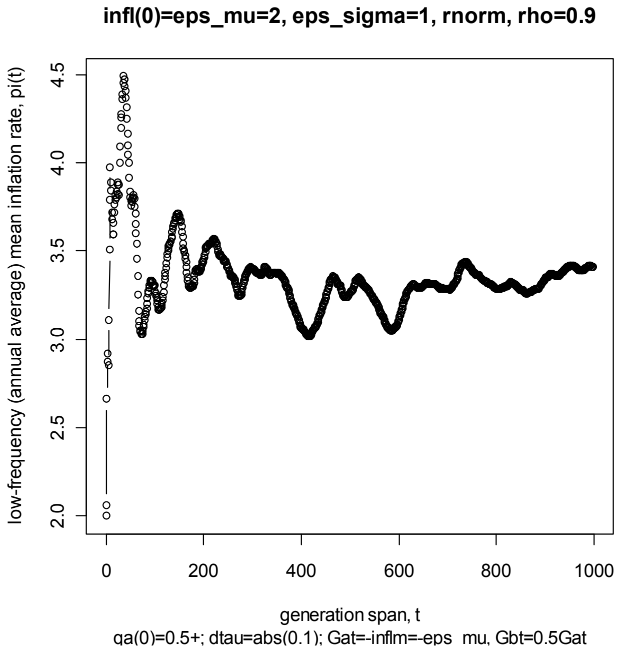

Figure 19: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, high inflation persistence, low mean and unit variance of the inflation shock

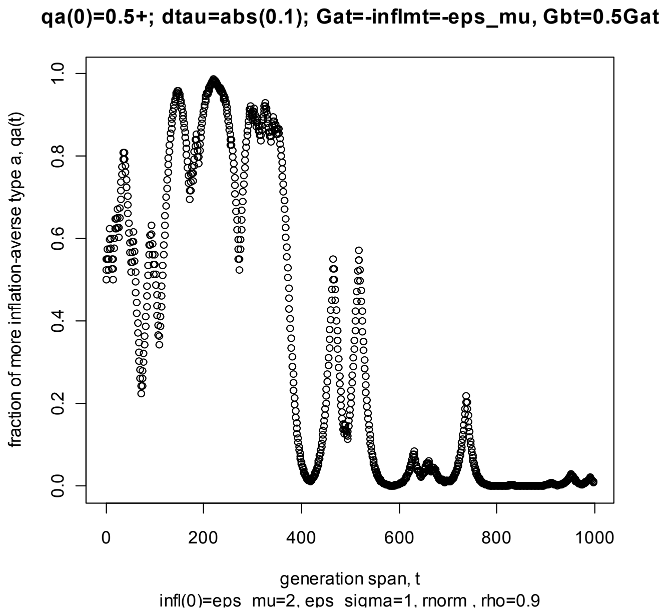

Figure 20: q_t^a dynamics under low vertical transmission differential, high inflation persistence, low mean and unit variance of the inflation shock

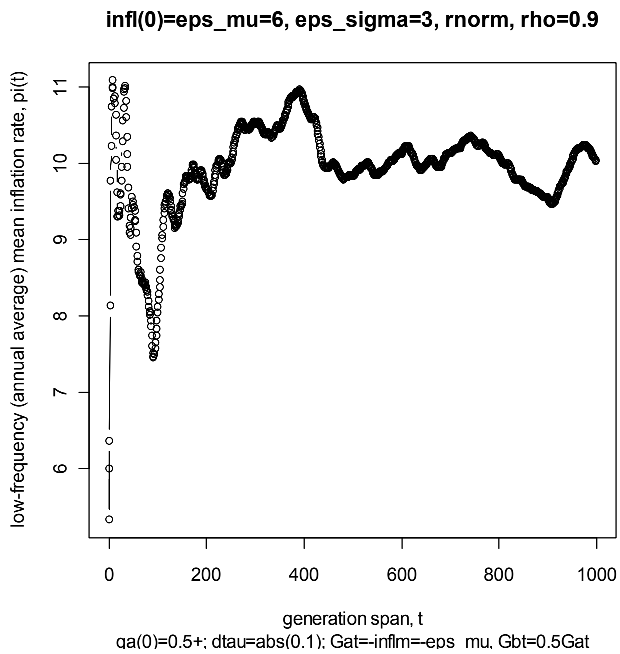

Figure 21: $\widehat{\pi}_t$ dynamics under low vertical transmission differential, high inflation persistence, high mean and high variance of the inflation shock

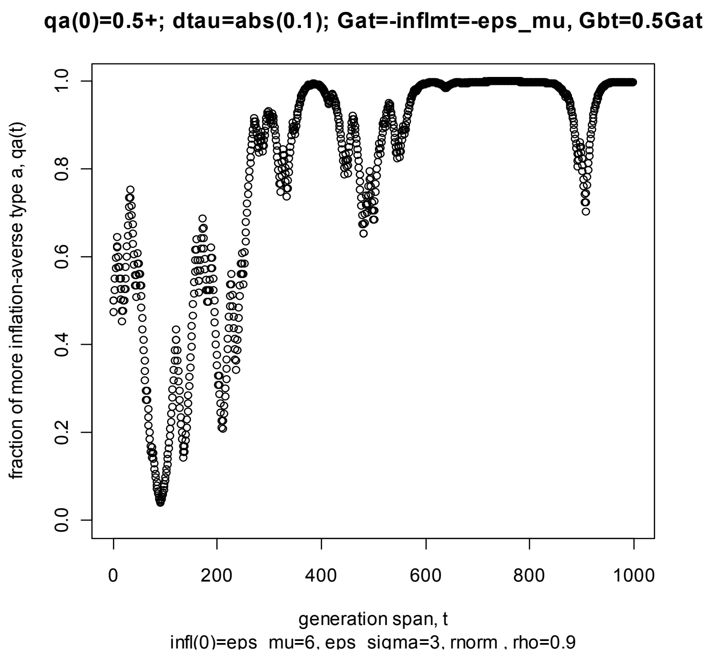

Figure 22: q_t^a dynamics under low vertical transmission differential, high inflation persistence, high mean and high variance of the inflation shock